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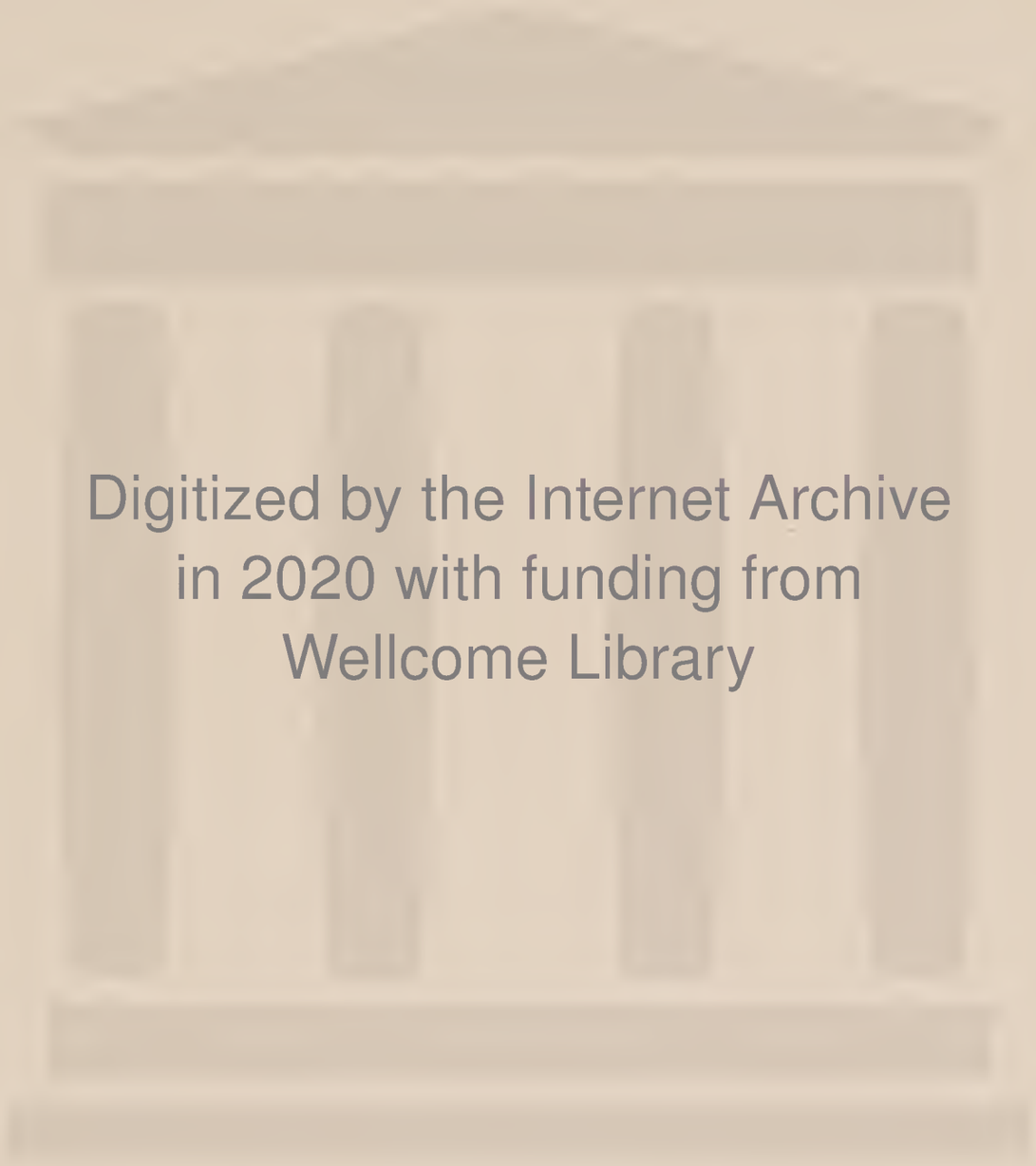
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THE MICROSCOPE.

AN

ILLUSTRATED MONTHLY JOURNAL,

DEVOTED TO MICROSCOPICAL SCIENCE.

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THE MICROSCOPE.

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ORIGINAL COMMUNICATIONS.

ASTIGMATISM AND ITS RELATION TO THE USE OF OPTICAL INSTRUMENTS.

BY ERNST GUNDLACH, ROCHESTER, N. Y.

ASTIGMATISM is a defect of the human eye which disturbs the true or normal vision in such a way that, for instance, a point appears elongated in one direction, or rather it appears in a line. It is caused by a certain irregularity in curvature of one or both surfaces of the crystalline lens of the eye, that is, the surfaces are stronger curved in one direction than in another, thus giving the crystalline lens different focal lengths in different directions, so that, for instance, a line may appear sharp and distinct in one direction but become quite blurred if the direction is changed. Astigmatism can be corrected by glasses one or both surfaces of which are of a convex or concave cylindrical curvature, and if, beside this defect, the eye is either short or far sighted, a certain combination of such cylindrical curvatures and their axial directions, concave or convex as the case may require, will at the same time correct both defects and make objects appear as they do to the normal eye. Indeed such glasses are made as spectacle glasses with complete success, but however, the determination of the correct formula for the proper construction of such glasses requires a rather complicated and systematic examination of the defective eye, which can only be accomplished by a specialist thoroughly familiar with this branch of science. Astigmatism is very common, and even the healthy eye is not free from it. The curvature of the crystalline lens is a little shorter in vertical than in horizontal direction, thus making a line of a certain length appear shorter when

seen in horizontal and longer in vertical position provided the distances in both cases are equal. Although the disturbance of clear and distinct vision may not be directly perceptible to the healthy eye under ordinary circumstances, it will become quite apparent if the pupil is unusually enlarged, as is the case in the dark, and the eye is directed to an isolated object the light power of which is not sufficient to cause much reduction in the size of the pupil by contraction. In cases of a high degree of astigmatism the prismatic colors will appear at the edges of objects in certain directions, according to the direction of the astigmatic axis, and add to the indistinctness.

Having thus given a brief account of the nature of astigmatism and its interfering influence to the perfect and natural use of the eye, and the remedy of the defect of the same by the use of spectacle glasses of peculiar construction, it remains to consider the relation of the astigmatic eye to the use of optical instruments.

The telescope and microscope serve to increase the power of the eye, not only by simply showing us an object on an enlarged scale and with a wider angle of view, but also at the same time—by means of increased quantity of light—enabling us to distinguish shades of color or close lines at a smaller angle of view than the unaided eye is capable of doing. This latter property of the optical instrument we call resolving power. It is dependent on the angular aperture of the instrument and is directly proportionate to it. It gauges the distinguishing capacity of our eye to an extent which it has no opportunity to develop under ordinary conditions. In other words, the telescope and microscope not only increase the angle of view, that is, magnifying the object, but also the angular aperture, and consequently the resolving or separating power of the eye. To those unacquainted with the use of optical instruments the amount of magnifying power may seem to be the most important, if not the only, condition of the capacity of the instrument, but the experienced manipulator knows too well that high magnifying power is of no value without a corresponding amount of resolving power. A telescope of six inches aperture will separate a double star that a two-inch glass is incapable of showing any trace of separation in, even though both instruments are of

the same magnifying power. The difference is due alone to the fact that the six-inch glass increases the angular aperture of the eye three times more than the two-inch. The principal endeavor of the optician in constructing optical instruments is not the highest possible magnifying power—indeed there is no special difficulty in this direction—but to combine with a given magnifying power such high angular aperture with a minimum of optical errors so as to increase the resolving power to the highest possible degree, so that the closest lines or dots can be distinctly separated from each other. But any optical instrument, however perfect it may be in its construction, will fail to perform to the satisfaction of even the most experienced operator if his eye is optically defective in such a way as to interfere directly with the normal performance of the instrument, and astigmatism must be regarded as such a defect. Near and long sight is corrected by simply focusing the instrument. But on our present instruments there is no means provided to correct astigmatism. The astigmatic microscopist may fail to separate some close and fine lines, which the day before under more favorable conditions to his astigmatism he saw quite distinctly; and, on another occasion, he perhaps experienced a similar change within a few minutes without any change in conditions except that he accidently changed his own position to his microscope by a turn of ninety degrees around the table, thus placing his astigmatic axis in a more favorable or unfavorable direction, as the case may be, to the direction of the fine lines.

The telescope as well as the microscope shows the errors produced by astigmatism. Close double stars appear different in the angle of separation at different times, or, at times become too indistinct to be separated at all, owing to the change of their line of position to the astigmatic axis of the observer's eye. Circular objects, such as faint clusters, nebulæ and comets, appear elongated, winged, or in other way of irregular shape. In fact there is not a case possible where astigmatism could not be to some degree injurious to the perfect definition of the fine details of an object, and this is increased the higher the perfection of the instrument.

Having thus explained the general injurious effects of astigmatism on telescopic and microscopic observations, it remains

to find a suitable remedy, and, as such, I propose a most simple and effective one in the use of an eye-piece of an asymmetric form so as to just neutralize the asymmetry of the crystalline lens of the eye. This can best be done by making the outer surface cylindrical instead of spherical or plane. It may be made either concave or convex as the requirements of the case may demand. The eye-piece must be constructed with special regard to the purpose so as to place the asymmetric surface in such close proximity to the eye that no perceptible secondary distortion is produced by the oblique direction of the eye toward the edge of the field, and, at the same time, the prismatic colors dispersed in the direction of the astigmatic distortion must be neutralized.

I intend to construct such eye-pieces, and expect to start with a one-inch. To enable the applicant, for this special purpose at least, to be his own examiner for astigmatism, I intend to furnish with the eye-piece three eye-glasses, alike in mounting but different in the degree of asymmetry, for selection. The difference being such as to practically approach both limits of common astigmatism, and the one of the three lenses nearest in asymmetry to that of his eye will correct his astigmatism to an undisturbing minimum. The observer will then have to test all the lenses, beginning with the weakest, on a suitable object, slowly revolving the eye-piece until its best position is found. Mark this position, and do the same thing with the other lenses. After this, compare the action of the lenses, each in its best position, to find the one best fitted for the eye. Of course the eye piece, or rather its asymmetric eye-lens, must then always be used in the same position to the astigmatic axis. To do this there will be no difficulty when using the microscope, but for the equatorially mounted telescope a special contrivance may be required, so that the position of the eye-piece may be easily controlled in the dark by the fingers and corrected after each change of the position of the body.

As soon as an "exchange" notice has served its purpose will the author of it please notify us, that we may make room for others now waiting.

METHODS OF STUDY.

FOURTH NUMBER.

ALBERT E. JENKINS, ANN ARBOR, MICH.

STAINING.

IN the ever increasing activity of microscopical research, the subject of staining receives more general attention than any other step in the preparation of specimens, but until recently this study has been entirely empirical. As a consequence, staining has by many been regarded as an end in itself, and in the effort for variety and something new, both the mineral and vegetable kingdoms have been ransacked for unusual and striking colors. But while to some a specimen may have a possible esthetic value from a combination of bright tints, it should always be remembered that the tingeing of sections is a powerful means of analysis, making distinct differences in structure and composition, and rendering visible much that otherwise could not be seen at all. In view of this it may be written that the need now is not new dyes so much as careful and accurate tests of the action of those already known, and how they may be influenced and made more serviceable by use in connection with other reagents, especially those which will increase the selective power of the stain and render it more permanent.

Since Hartig (1854) and Gerlach (1858) first employed carmine in histological technology, it has been noticed that the different elements of tissues and cells would take only certain colors, or that they would retain them with varying degrees of resistance when subjected to further treatment. This election or determinance of color for known elements is the foundation of all staining processes, and is equivalent in value to chemical reaction, to which indeed it is akin.

As to how a dye stains there is at present much discussion in learned circles. Formerly it was believed that the coloration was due to a simple absorption of the dye-stuff, but while this is undoubtedly true in some instances, it falls far short of explaining many of the complicated processes of modern microscopical technics. Recent investigators have very generally attributed the phenomena to chemical action, the formation of new and definite compounds from the substance of the tissue and the dye-

stuff; but if the writer may here state his views, the change is molecular and not atomic and so cannot be regarded as chemical, or else molecular differences are simply made manifest by the ingestion of the dye. A discussion of this subject, however attractive it may be, would be out of place in an elementary article such as the present number, but it may be well to state that it is almost certain that color depends upon the molecular constitution of a substance and not upon its chemical nature. The photographic differences which are developed by staining, may also be adduced as evidence for this belief, because the actinic powers of the various structures are quite changed by the process, so that they shown in different intensities in the photograph. It cannot be denied that in some instances at least, there is a change greater than that due to a simple impregna tion by the stain. Thus many dyes, notably the aniline series, tint a section different shades or even colors in its various parts, and the only reasonable explanation of this is that different chemical compounds are formed in these several parts or that molecular changes in different degrees are induced by the staining medium.

This subject will again be considered in a future article while treating of the anilines, the "Inversion of Color," etc.

METHODS AND FORMULÆ.

It will be found in almost all cases that the alcoholic dyes give the best results. They are quicker and more certain in their action, the liability of maceration and structural degeneration is lessened or quite removed even though the immersion is unavoidably prolonged, and there is no danger of a precipitate in the alcohol hardened specimens such as usually occurs when aqueous solutions are employed. As it is now customary to stain in mass when possible, the alcoholic media are indispensable as their penetration and preservative power is so much better, the deeper portions of the object being acted upon in the same degree as the surface.

The grade of alcohol used in making these solutions may be determined by the following principles: The stronger the alcohol the greater its preservative action and penetration, but the more

*A. E. Jenkins, Methods of Work, No. 2.

diffusely will it stain and the longer it takes for the completion of the process, as the higher grades of alcohol have less solvent powers than the lower.

Cochineal.—This is the dried body of an insect, a bark louse (*coccus cacti*) which is very abundant in Central America. Only the female is of value, and to facilitate the extraction of the coloring matters, the amount used should be finely pulverized.

MAYER'S COCHINEAL TINCTURE.

Cochineal	8 to 10 grms.
Alcohol, 50, 60 or 70 per cent.	100 cc.

The cochineal in fine power is allowed to soak in the alcohol for a week and the mixture then filtered, or the tincture may be made after the usual manner of percolation employed by pharmacists. The resulting solution is a clear deep red fluid which however, needs occasional filtering. It can be used whenever a simple alcoholic dye is required and with careful management produces very beautiful effects. To have the best success it is necessary to observe the following precautions: Before using, the object should be placed for a short time in alcohol of the same percentage as that which was employed in making the solution, otherwise from the variety of substances in the dye and their different solubilities, there will be a precipitate. If the fluid is found too strong it may at any time be diluted with the same alcohol. After the staining, which requires from a few minutes for sections to a day or two for large objects, the surplus dye must be removed by immersion in alcohol of equivalent strength, until the specimen no longer yields any color. Over staining is removed by acid alcohol, (1-10 per cent. hydrochloric or nitric acid, or one per cent. acetic or formic acid, and alcohol 70 per cent.) after which the specimen is again placed in pure alcohol.

ALUM COCHINEAL.

Cochineal	1 to 2 grms.
Alum	1 to 2 grms.
Alcohol (or water)	100 cc.

The cochineal and alum are dissolved together in the medium selected, which is then evaporated down to 60 or 70 cc., and filtered. This solution stains the cell contents and wall and the inter-cellular substance as well as the nucleus.

The color reactions of these cochineal tinctures on tissues are very delicate and easily influenced by the preliminary or subsequent treatment. The presence of various mineral salts will change the color from a red to a blue, or even green or gray, and it would be a useful and valuable work to systematize the action of these inorganic compounds, notably the chlorides of aluminum, tin, palladium and calcium, the acetate of lead, and the sulphates of copper and iron, on the several organic dyes in use by microscopists.

CARMINE (CARMINIC ACID).

This was the first staining medium to be employed in histological demonstrations and is still confessedly the most reliable. Bear in mind, it is not written that it is the best always because in some cases it will not answer at all, but for general study it cannot be excelled for the ease with which it may be used and the certainty of its action. The bright red tint imparted to tissues by its action has been urged as an objection to its use, but it is the writer's opinion that the red tinge is less trying to the eyes than the effort which must be made when the fine details of a complicated structure have a less marked color. Besides it has so far proven itself the most durable of the many dyes, a specimen once stained with it may without fear be subjected to any treatment in the embedding or mounting, or the object stained in mass may be kept in a preservative fluid until wanted for sections. It is probable that a study of carmine and a development of its capabilities would fit it for any work.

BORAX–CARMINE.

1. Make an aqueous solution of borax (4 per cent.) and carmine (2 or 3 per cent.), heating till both are dissolved.

2. The above and 70 per cent. alcohol are mixed in equal parts and allowed to stand for two days and then filtered.

By reason of its superior penetration, this solution stains more uniformly than any other with which I am acquainted, except perhaps, the one which follows. The specimens may be left in it from 10 to 30 minutes for small pieces and sections, to one or two days for large objects such as embryos, etc. When the staining is completed, the specimen should present a uniform dark wine color. It is now transferred to *acid alcohol* (see un-

der cochineal) until it is a vivid red, and then immediately removed to pure 70 and afterwards 90 per cent. alcohol. If thought desirable for delicate specimens which would suffer if placed in a weaker alcohol, the above solution may be changed by using 50 or 60 per cent alcohol and dissolving both the borax and carmine in that. The addition of a slight amount of glycerine, about 20 per cent., is sometimes very beneficial.

BERMANN'S CARMINE.

Take 5 grms. of carmine and dissolve in 8 grms. of ammonia, dilute this to 100 c. c. and add an equal volume each of absolute alcohol and glycerine. This fluid improves with time and may be used repeatedly.

The after treatment is the same as recommended with borax-carmine. The effect of the glycerine is to increase the intensity of the staining.

The above two media cannot be too highly recommended.

BEALE'S FLUID.

Carmine	10 grains.
Ammonia	½ dr.
Glycerine	2 oz.
Water	2 oz.
Alcohol	½ to 1 oz.

The carmine is dissolved in the ammonia and the other components added. It is best to allow the mixture to stand open for a few hours to allow a possible excess of ammonia to evaporate. This fluid may be used for staining in toto if so desired, though for this purpose either of the above two fluids are better. In all cases the specimens are improved by the use of acid alcohol.

ALUM-CARMINE.

An aqueous solution of alum (1-5 per cent.) is boiled with an excess of carmine (½ or 1 per cent.), allowed to cool and then filtered. A few drops of carbolic acid or a crystal of thymol should be added to prevent the growth of fungi. This colors quickly, though for objects in toto they may be left in the solution for 24 hours. The above stains the nuclei more strongly than the other portions, but this effect is made more emphatic if the tissue is treated with acid-alcohol.

If before staining the specimens be first placed in *acid* gly-

cerine, (Acetic acid 1 part, alcohol 70 and glycerine 30) the coloration takes place more quickly and in greater intensity.

ACETIC ACID CARMINE. [BÖHM'S CARMINE ACETATE.]

Finely pulverized carmine is boiled in acetic acid (1 per cent.) until no more will dissolve. It is now allowed to cool and stand for a few days and then filtered.

For showing the karyokinetic figures, the sections from a freezing microtome or the fresh object are placed in the acid until saturated, then washed in water and examined. Or if desired, they can be immediately mounted in glycerine or treated with alcohol and clove oil in the usual manner and mounted in balsam. This fluid also largely takes the place of the dilute acetic acid of the laboratory for the light violet tint which it gives to tissues is a valuable help in studying its action.

ACID BORAX-CARMINE.

An aqueous solution of borax ($\frac{1}{2}$ per cent.) and carmine ($\frac{1}{2}$ per cent.) is made by heating, and then acetic acid added, drop by drop, until the color has turned from a violet to a red of about the intensity of Beal's carmine.

The above stains diffusely and cannot be employed for coloring in mass. Sections are quickly colored by it, and then treated with acid alcohol.

ALCOHOL CARMINE.

Carmine	4 grms.
Alcohol (80 per cent.)	100 c. c.
Hydrochloric acid	30 drops.

The carmine is dissolved and the solution neutralized by ammonia, which should be cautiously added that no excess is present.

DOUBLE STAINS.

CARMINE AND INDIGO-CARMINE.

Carmine	2 grms.
Borax	8 grms.
Water	130 c. c.
(2) Indigo carmine	8 grms.
Borax	8 grms.
Water	130 c. c.

The solutions (1) and (2) are made separately and filtered, then mixed in equal volumes. Sections which are stained in about twenty minutes are then washed in a weak solution of

oxalic acid and transferred through successively higher grades of alcohol and mounted.

PICRO-CARMINE.

The most extraordinary methods have been devised for preparing this really simple dye, but the writer has found no advantage whatever in those whose manufacture involves much labor and time. The following by Dr. Mayer answers as well as any and is easily made:

Two grammes of carmine are placed in twenty five cubic centimeters of water and enough ammonia added to dissolve the carmine. The whole is kept warm over a water bath until the excess of ammonia has evaporated and the fluid is a deep cherry red in color. It is then cooled and filtered. To the filtrate is added a saturated solution of picric acid in water until a precipitate begins to be formed. (About four volumes of the acid to one of the carmine). After again filtering it is ready for use, or—

To a solution made of 1 grm. carmine, 4 grm. of ammonia and 200 c. c. of water, add 5 grams of picric acid in crystals. Agitate well and decant the supernatant liquor. This is allowed to remain for several days with occasional stirrings, then evaporated to dryness in a water bath. To every 2 grams of the residue add 100 c. c. of water.

If the sections are treated with "acid glycerine," (see under alum carmine), before staining with picro-carmine, the coloration is sharper and more truly differential.

PICRO-LITHIC-CARMINE.

Lithium carbonate, saturated solution in water 100 c. c.
Carmine ..... 2½ grms.

To the above, made into a solution by heat, is added 2 or 3 parts of a saturated solution of picric acid in water. Used the same as the preceding.

PALLADIUM CHLORIDE AND CARMINE.

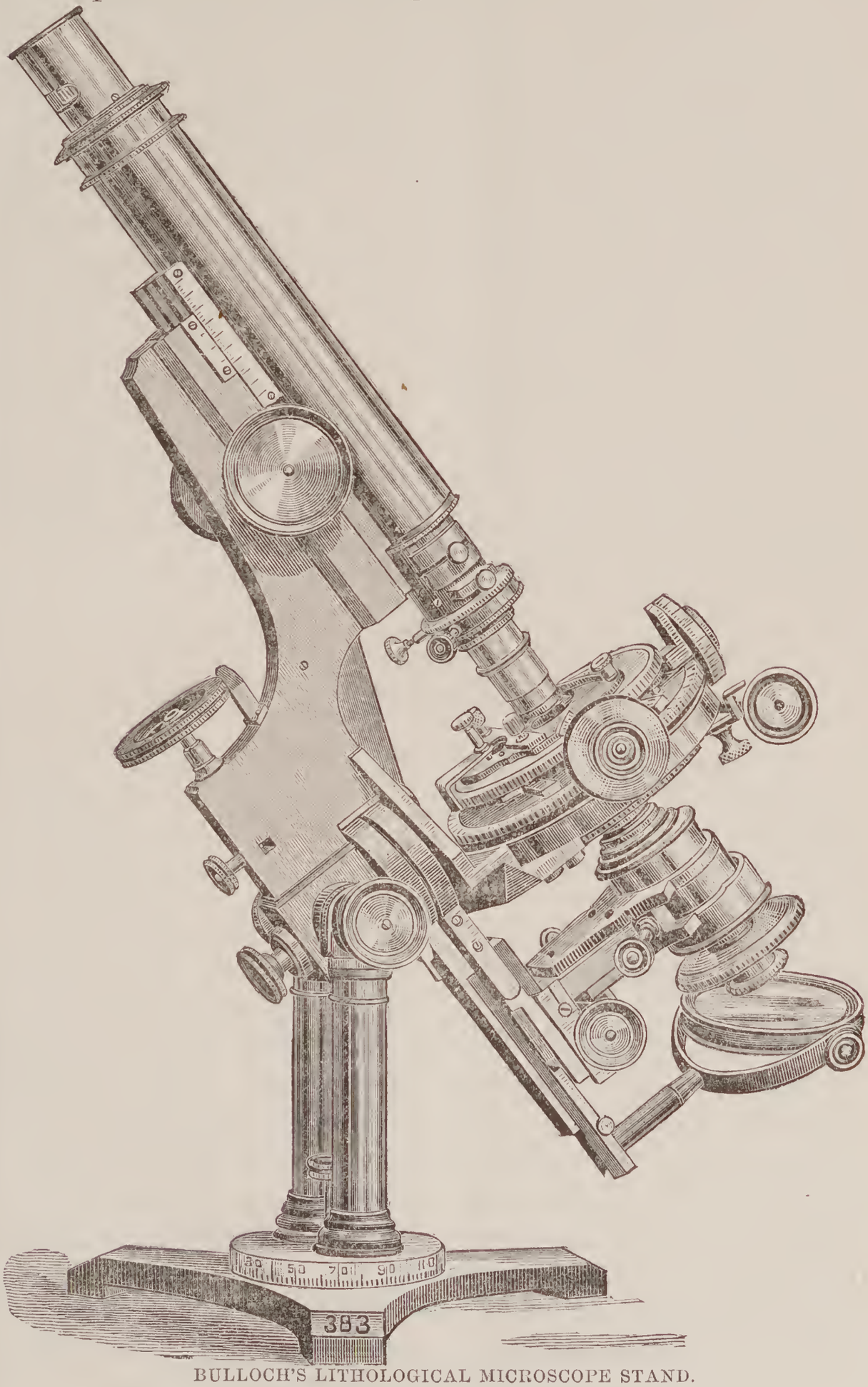
A ½ per cent. aqueous solution of the chloride of palladium is used for about 10 minutes, or until the section is of a straw yellow color. The specimen is then transferred to an ammonia carmine solution until red, washed and transferred through alcohol and clove oil to balsam.

BULLOCH'S LITHOLOGICAL MICROSCOPE STAND.

THE general construction, as shown in the illustration, is similar to the professional stand except in the following details: There are two stages, one with plain sliding object carrier. Each stage is graduated to fifteen minutes, and reading by a vernier to twenty seconds, and can either be resolved by hand, or by tangent screw as shown in the illustration; and which also acts as a slow motion. The worm cut on periphery of stage has 360 teeth, equal to single degrees, and the tangent screw-head is graduated to sixty, so that each division reads to one minute. The tangent screw can be thrown in or out of connection, as required. The above is common to both stages. The second stage, as shown in the illustration, is also furnished with a sliding object carrier, and with micrometer screws in two directions for the direct measurement of object without any reference to magnification. The screw threads are one-half millimeter, the heads being graduated to 250, so that each division reads to two microns. Again, by vernier, to tenths, equaling one-fifth microm. At the side of limb there is a scale reading to half millimeter; and the slow motion screw-head is graduated to 300, each division equaling one micro. The prism below fitting in the sub stage has a graduated circle of degrees, and a spring catch at each 90°. The prism at the lower end of the body-tube has a revolving movement by lever of 90°, and can be removed to the side by a slide similar to the "Wenham Binocular prism." At the lower end of the tube there is a Klein's Quartz plate and also a centering nose-piece. There is a goniometer eye-piece with crossed spider line, a Nichol's prism, and a cal-spar plate. The fitting is made adjustable, for if the cal-spar is not cut in the proper direction, the cross can not be placed in the center of the field without being slightly tilted.

In working, to change from polarized to ordinary illumination, the prism below the stage can be turned aside, leaving the wide angle condenser in position; or the whole sub-stage can be turned aside, which movement is supplimentary to swinging on axis in the center with the object on the stage. When the condenser is not required there is a supplementary sub-stage for the lower prism, so that the prism can be used close to the ob-

ject, and no light admitted, except that which has passed through the prism. Each stage has stops for maltwood finder, also stops for the small lithological slides.



BULLOCH'S LITHOLOGICAL MICROSCOPE STAND.

BULLOCH'S COMBINATION MICROTOME.

SINCE the description and illustration were published, the *microtome* has been further improved. The attachment or clamp for holding the knife, consists of two disks; and when placed in position at zero, which is indicated by a spring stop, are four-tenths inch thick; each disk is two inches in diameter, and made in the form of a wedge of about six degrees. The lower disk is divided into 25 parts, and by the proper position of each wedge, any inclination or adjustment can be given to the knife. The periphery of the elevating wheel has been cut with ratchet, the same as others with feeding attachment; but the adjustment for graduating the amount of elevation is on the block which carries the knife, and is adjusted by means of a sliding arm-piece; and can be gauged from one to twenty teeth, or 1-200 to 1-10 mm. By this method the knife carrier can be used on the full length of the bed at any adjustment of the feeding attachment. A ribbon carrier has also been attached.

EDITORIAL NOTES.

PROF. SMITH'S NEW WORK.—We have recently been enjoying the great pleasure of examining the plates of Prof. H. L. Smith's work on "*Contributions towards the life history of the Diatomaceæ.*" This work has just been completed after years of most earnest labor. The package before us contains forty-eight colored plates on heavy board, 14 x 18 inches. Each plate is most beautifully finished in water colors of various hues, representing some important point in the life history of these interesting forms. To examine the plates alone for their artistic finish would be both pleasant and profitable to any one who loves that which is beautiful in art. When we add to this the fact that each plate represents to us some important fact in natural science, presented by the very highest authority in the world on this particular subject, and presented, too, for the first time, we are ready to assert that no more valuable contribution has been made to science during the present generation. It is the first complete work on this subject ever offered

to the American people. It represents the results of a long, earnest life devoted to scientific pursuits. It is a work that will be a standard authority for very many years to come.

We do not know what publishing house will bring out the work, but it is evident that to reproduce these plates alone will cost many thousands of dollars. The only way, it appears to us, that any publisher could afford to produce such a work would be to issue it in monthly parts, with two or three plates in each issue, charging for the same about one dollar a part. In this way the whole work could be procured at a total cost of about fifteen dollars and without any great sacrifice on the part of the purchaser. We are writing this notice without the knowledge of Prof. Smith, who kindly sent us the drawings at our earnest request. Nothing would contribute to our ambition more than to publish and introduce such a grand work as this. Did we have any assurances from our friends we would make Prof. Smith an offer to publish the work at once. Should a large number of our readers be pleased with what we have announced, and should Prof. Smith not procure a publisher until next month, we may have more to say on the subject. We ask no pledges, only words of encouragement.

WE are in receipt of an illustrated catalogue from Mr. S. N. Ayres, of Jamestown, N. Y. It gives a list of his micro-photographs and micro-photo charms. Mr. Ayres' work is unique in character and our readers had better send for one of these lists.

WE have received a note from one of our subscribers which speaks for itself. "As a fellow F. R. M. S. allow me to say a few words regarding paragraph in your MICROSCOPE, Sept., '85, page 207. 'Mr. Bulloch of Chicago, * * * asked for some kerosene, etc.' The word kerosene is not derived from the Greek, was coined by a person not knowing that language, dictionaries to the contraries—it is a patent granted this company. Originally it was made from coal or shale and afterwards adapted to petroleum. Kerosene is the result of two distillations with an intermediate chemical treatment. All other illuminating oils made from petroleum are by a single distillation finished by chemical treatment in the agitators. Mr. Bulloch was correctly informed."

ANOTHER letter may be of interest to our readers also. "Inclosed find the one dollar for the MICROSCOPE another year, which I would not know how to do without. Its improvement in every way is too well known and accepted to make any word of commendation from me needed. I think next to Grover Cleveland I would rather be an editor of so good a microscopical journal. In the last number under your own name you ask in respect to E. M. Nelson's remark as to the comparative ocular fatigue in the use of daylight or lamplight for the microscope, 'How is it with yours?' That distinguished microscopist has startled us many times before with radically innovating similar or kindred assertions, many of which I have failed to accept, but in this his experience agrees with my own *in the use of the monocular.* With the binocular give me daylight for prolonged consecutive observation—north light of course."

WE are in receipt of a number of micro-photographs of *amphipleura* mounted in Prof. Smith's new medium. Spencer's 1-10 homogeneous, of 125° balsam angle was used. There are also some views of "broken sections of a butterfly's wing" taken with the binocular microscope.

One plate represents the longitudinal and another the transverse lines of the *amphipleura.* Mr. N. Baldwin, of Wichita, Kansas, has our thanks for this remembrance.

A NUMBER of our friends have sent us their renewals, but there are many hundreds more to follow. If you will send us just a dollar we will credit you for our journal for 1886 and will be greatly obliged besides. Your help will never be more welcome. "Many a little makes a muchel."

OUR February number will contain the third paper by Mr. Walmsley, on Photo-Micrography, The illustrations are now being prepared for the same.

THE most favorable news comes from the executive committee concerning the preparations for the next annual meeting of the American Society at Chautaugua. There are suitable rooms for the daily sessions and also for the working session. Of one thing we are assured, it will be a most harmonious session. There is not any subsection of "Geology" hence no room for "antediluvian scientific fossils."

MR. GRUNOW has just issued a new price list of his objec tives. Send for one.

WE will give 25 cents each for six copies of the December number, 1882, and also for the April number, 1883. We desire four more copies of the January number, 1884. See our December number.

SELECTIONS.

DANGERS IN FOOD AND DRINK.

Fancy if you please, the state of mind of a citizen of New York as to the deceptions and dangers which may exist for himself and his family in the food and drink they consume. That the milk may be watered or skimmed, that the butter may be oleomargarine, or that the sweetening for his buckwheat cakes may be glucose syrup, he has long since learned. Notwithstanding this, he manages to make a tolerable breakfast, only reflecting, as he sips his morning coffee, that not long since he has heard that raw coffees are frequently "painted," as those in the trade term it, with various colors, some of which contain poisons. At his dinner he would like some vermicelli, but he has recently read in the papers of prosecutions in the courts for coloring vermicelli with the poisonous chromate of lead; he would like a salad, but remembers that a few months ago there was a stir about the sale of mustard colored with a poisonous coal-tar color; he would console himself with pickles by way of condiment, but again fears that he will only imbibe copper or lead in another form; an effervescent mineral water might serve as a substitute, but he has been informed that many manufacturers of mineral water in the city use for their wares water contaminated with drainage. In despair, he thinks to refresh himself with ice-cream, but again hesitates, since it is reported that one of the ingredients may be gelatine whitened with zinc white. The good citizen, knowing not which way to turn, experiences a reaction, concludes to take his chances, and eats and drinks heartily, philosophically reflecting on the added significance of the saying, "Let us eat and drink, for to-morrow we shall die."

It is my purpose here to give a brief account of some of the

dangers which have been discovered, and, it is to be hoped, materially diminished, by the action of the New York City Health Department during the past few months.

As to coffee: Two forms of treatment have been applied to raw coffee in order to affect the color and general appearance of the bean—"sweating," as it is cometimes termed, and revolving in cylinders. The latter process is termed "polishing" when powdered soapstone of nothing whatever is mixed with the coffee, and "painting" when mineral pigments are added to change the color. The coffee is usually moistened to soften the exterior; sometimes a little gum arabic is dissolved in the water used.

When coffee was brought here by sailing vessels, requiring a long time for the voyage, the coffee underwent a change in the hold analogous to the sweating process in curing tobacco, or that used in the preparation of some kinds of tea. It is worthy of remark that a decided improvement in flavor is imparted by such a process to articles of the kind. The effect on the coffee was not only to improve the flavor, but to alter somewhat the form of the bean, while the color was changed from a brownish green to a more decided brown. When steamers began to carry coffee, the time of the voyage was too short to permit this sweating process to produce such an effect, and a method of treating the coffee with moist heat (140° to 150° Fahrenheit) was devised, which imitated in some respects the conditions produced in the hold of a sailing vessel. With some coffees this treatment produced a perceptible increase in the size of the bean, as well as the alteration in flavor and tint, and in this way, except in point of color, some South American coffees could be made to imitate the more popular "Java."

"Polishing" was originally practiced, without the addition of any mineral substances, to improve the general appearance of the raw coffee; but it was accidentally discovered that the addition of small amounts of pulverized soapstone effects a much more decided improvement. This led to the use of mineral substances and pigments to affect the color, until now coffee can be "painted" any desired shade by those skilled in this b anch, just as one can get from a dyer any desired shade on woven frabrics. A list of the substances used in this "paint-

ing" may here find a place: gum arabic; Venetian red; French chalk, or soapstone; Silesia blue; chrome yellow; Prussian blue; turmeric; burnt umber; yellow ochre; drop black.

The Silesia blue consists of a mixture of Prussian blue and barytes. In the sample examined a small amount of lead (probably there as white lead) was detected. The "drop-black" is ground bone-black. The other names require no explanation. Of these colors only chrome yellow (chromate of lead) is *per se* poisonous. The ochres, however, are sometimes the product of the weathering and decomposition of pyrites containing arsenic or copper, and these elements can frequently be detected in them. In the colors examined, only the burnt umber showed arsenic; still in consequence of careless handling, poisonous materials sometimes get mixed with the substances used.

The use of colors containing poisons for "painting" coffee has been forbidden, and to a large extent stopped by the prompt action of the Health Department of New York and Brooklyn. Although the aggregate number of pounds of coffee thus treated is no doubt very large, the proportion of the entire amount of coffee sold has been small, and in cases of "painting," as has been seen, but few of the colors have poisonous constituents. Nevertheless, so long as buyers of raw coffee follow the older traditions, depending upon color as their guide, and

> "Do not care for dirty greens
> By any means."

or the reverse, some encouragement is given to these practices in defiance of the law, and only the enlightenment of the buyers to suit the changed conditions of the coffee-trade can effectually stop "painting." At the present time the most expert buyers depend very little upon color, but judge of the samples by the appearance and aroma of the roasted beans, and the flavor of the infusion.

The coloring of vermicelli with chrome yellow seems to have come about in this wise: A large portion of our population, chiefly Germans, are very fond of what they term "Eier Nudeln," a yellow vermicelli, the color being supposed to be imparted by the admixture of eggs with the flour used in the manufacture. Some unscrupulous manufacturers, having

found that for their trade a yellow color in the vermicelli was sufficient to work upon the imaginations of their customers, omitted the expensive egg, and added instead some yellow coloring material. Turmeric. Martius' yellow (a coal-tar dye), and chrome yellow (chromate of lead) are colors which have been used. The last is by far the most dangerous addition, and at least one case of lead-poisoning in this city has been traced directly to this source. In some families the custom of making the nudeln at home prevails, which is certainly a safe plan. In some cases the manufacturers were most probably ignorant of the properties of the yellow coloring matter (chrome yellow) which they used. They simply used the material because other manufacturers did, and they found a sale for goods so colored. It is to be hoped that, in consequence of the publicity which has been to this matter, this form of danger may soon become a matter of history only.

Some persons imagine, when they buy mustard from a grocer of good standing, that they are receiving only the flour of mustard-seed, after grinding and bolting. They are almost invariably mistaken. If they would give what they supposed, the article would most probably lack the bright color to which they are accustomed, since the flour of farina from the four or five different kinds of mustard seed now in the market has in but one or possibly two cases that brilliant tint; as a condiment, the genuine mustard flour would be thought to be too sharp and bitter, and as an ingredient in mustard plasters, it would be unendurable. It is also asserted that pure mustard farina does not keep well. What is ordinarily sold under the name of mustard is a mixture of mustard farina—after partial extraction of the oil—with flour or starch and tumeric; and this method of preparing the condiment has become so general, that it is not regarded as an adulteration by the manufacturers. By regulation of the New York State Board of Health, of March, 1883, manufacturers of mustard are allowed to add sixty per cent. of flour and tumeric to mustard farina, provided that fact is distinctly stated on the label of the package. These additions are not harmful. Tumeric is itself a condiment, being a constituent of the well-known curry-powder. Its physiological effects are described by the United States Dispensatory as similar to those of ginger.

A few months since it was discovered that some manufacturers were not only using in their lower grades of mustard excessive quantities of flour, but were replacing the flour in part with terra alba, and were substituting for the tumeric a coal-tar color—Martius' yellow, scientifically termed "calcium dinitronaphthalate." This color, besides being as explosive as gunpowder when unmixed with anything else, was proved by experiments on dogs to be poisonous.

That copper compounds have frequently been used to give a bright green tint to pickles and preserved green vegetables generally has long been known. It may perhaps not be known that minute quantities of copper have been found in almost all vegetable products, apparently as an accidental constituent, since the amount varies according to the soil upon which the cereals, potatoes, etc., have been grown, and the element is entirely absent. In an experiment connected with this investigation, copper to the extent of 2.57 parts of the metal per million was found in fresh cucumbers bought in the market. In some molluscs, and in the coloring matter of the feathers of certain tropical birds, copper is an essential constituent; it has frequently been detected in the human body.

The question as to whether copper compounds are really poisonous has been vigorously disputed, and cannot be regarded as positively settled. It seems probable that to certain persons, possibly the larger portion of mankind, they are poisonous, while to others they are not.

The westerner who visits this city on business or pleasure may "forget to taste" the Croton water; but how would he feel if he were told that the sparkling effervescent water which he drank with his claret at some fashionable club, even though it bore some well known foreign brand with the label and cork-fastening looking as though the bottle had just come from abroad, was drawn from a well sunk on Manhatten Island, and was contaminated with the drainage of some of its busy streets and leaky sewers. Yet that has been often the fact.

It must not be rashly inferred from the items which from time to time are published that *everything* which we purchase in the way of food and drink is bad or adulterated. Probably if the proportion of adulterated articles to the whole number

of sales, say in a day, a month or a year, could be calculated, it would be found to be small; and if those articles which were really dangerous or had received dangerous additions were only reckoned, the proportion would be still smaller. People may be horrified to read that of more than six thousand samples examined in the Paris municipal laboratory last year, over fifty per cent. were found to be bad; but an important point must not be overlooked. Chemists, or, as they prefer to call them in England, "analysts," do not frequently examine an article of food except to confirm or disprove a suspicion that it is "no better than it should be;" as a consequence, the percentage of adulterations discovered is usually high. In other words, the "anatomist" is apt to see the worst side of the question.

It is unfair in the extreme to assume that all dealers are dishonest, or that if they have a choice they will invariably prefer to adulterate with the most deleterious substance obtainable. What is at the bottom of all this is a desire for gain, and results from innumerable causes. Some manufacturers and dealers endanger the health or the lives of their customers through sheer ignorance, and take the same risks themselves without being aware of it. They imitate the practices of other manufacturers so as to be able to compete with them, and only know that their goods are marketable. Questions of casuistry do not trouble them. Adulteration is supposed to embrace the element of fraud, yet, more frequently than is supposed, fraudulent intentions are absent. The moral standards of men also are variable. One man considers anything moral which is not illegal; another goes a step farther, and regards any act of his as consistent with morality, provided he doesn't get caught. Adulteration is sometimes technical, rather than actual. For instance: some grocers buy strong vinegar, and dilute it to the point which they find their customers preferred. In Massachusetts, if vinegar contains less than five per cent. of acetic acid, it is regarded as adulterated. In England, three per cent. is the limit. If now a grocer should dilute his vinegar so that it contains but four per cent. of acid, it would be adulterated in Boston, and not adulterated in London.

The general laws of the State of New York are so constructed, or interpreted, that *injurious* adulterations or additions to food are illegal, while the plea of ignorance is seldom,

if ever, accepted as a bar to conviction in the courts, though it may have weight when sentence is pronounced. Our citizens must be protected from the ignorance and carelessness as well as from the dishonesty of dealers in articles of food and drink. The law rightly assumes that dealers have sufficient acquaintance with articles in their line to be able to distinguish between what is good and what is bad.

From an article by Elwin Waller, in the December Century.

THE TELESCOPE AND MICROSCOPE.

Dr. Chalmers said, as he viewed the telescope in connection with the microscope: "The one led me to see a system in every star; the other leads me to see a world in every atom. The one taught me that this mighty globe, with the whole burden of its people and its countries, is but a grain of sand on the high field of immensity; the other teaches me that every grain of sand may harbor within it the tribes and families of a busy population. The one told me of the insignificance of the world I tread upon; the other redeems it of all its insignificance; for it tells me that in the leaves of every forest, and in the flowers of every garden, and in the waters of every rivulet, there are worlds teeming with life, and numberless as are the glories of the firmament. The one has suggested to me that beyond and above all that is visible to man there may be fields of creation which sweep immeasurably along, and carry the impress of the Almighty's hand to the remotest scenes of the universe; the other suggests to me that, without and beyond all that minuteness which the aided eye of man has been able to explore, there may be a region of invisibles; and that, could we draw aside the mysterious curtain which shrouds it from our senses, we might there see a theatre of as many wonders as astronomy has unfolded—a universe within the compass of a point, so small as to elude all the powers of the microscope, but where the wonder-working God finds room for the exercise of all his attributes; where he can raise another mechanism of words, and fill and animate them all with the evidence of his glory."—*Tidings from Nature.*

EXCHANGES.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medieal books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

I HAVE Zentmayer's improved centennial microseope binocular, including all improvements to date. Same as new. Cost $550. will sell for $400. A. G. FIELD, Des Moines, Iowa.

WANTED—One copy of Vol. I., No 1 of Phin's Journal of Microscopy. Will give a well mounted and interesting microscopic object. M. S. WIARD, New Britain, Conn.

ONE-TENTH immersion, adjustable obj. by Gundlach, for sale.
HAROLD PLOWE, 136 High st., Peoria, Ill.

WANTED—A Microsteriopticon in exchange for a first elass 1-10 Immersion Objective.
WM. C. BRITTAN, 11 Washington Ave., Detroit.

FOR EXCHANGE—A Hartnack 1-11 objeetive, 170°. Will exchange for a good low power glass.
A. Y. MOORE, 67 Euclid Ave., Cleveland, Ohio.

FOR EXCHANGE—One Fiddian Microscopic Illuminator, one Brass injecting Syringe with four pipes and stop cock, one Microtome (Brass) Rivet, improved, with knife, one Dr. Seilers Section Knife and Carrier, one warm Stage with Thermometer and Gas Chamber in exchange for first class Polariscope with goniometer Eyepiece or collection of thin mounted Rock sections.
DR. HENRY FROEHLING, 17 South 12th street, Richmond, Va.

FOR EXCHANGE—Zeitschrift fur wissenschaftliche Mikroskopie, Volume I., 1884. Would prefer type-slides of diatoms in exchange. Address,
A. B. AUBERT, Orono, Penobscot County, Maine

FRESH WATER ALGÆ, very numerous speeies, inclnding Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

FOR EXCHANGE—Eleven varieties of unmounted starches (including Calabar Beans, Ginger, Calchicum, Tous les Mois, etc.,) for one mounted slide objects pertaining to vegetable histology preferred. C. F. BOOTH, 278 Greenwich St. N. Y. City.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well elcaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50.
C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M. D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Baciliaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W, WESTOVER, M. D., St. Joseph, Mo.

THE MICROSCOPE.

VOL. VI. ANN ARBOR, FEBRUARY, 1886. No. 2.

ORIGINAL COMMUNICATIONS.

HOW TO EXAMINE EPITHELIUM.

C. H. STOWELL.

COLUMNAR EPITHELIUM.

For samples of columnar epithelium remove a portion of the intestine of a recently killed rabbit or cat, and wash carefully the mucous membrane by flowing over it some of the salt solution. Then with the point of a scalpel transfer a small portion of the membrane to a glass slide and to it add a drop of the staining fluid. Certain of the villi will be removed entire but a few of the columnar cells will be seen floating free in the field. An oval nucleus is present in each cell. These cells terminate usually in a fine point, a few are bifid, while others terminate in a rounded extremity. At the fine border of the cell is a thick margin in which free vertical striæ are seen. If the animal be killed during digestion, globules of fat within the cells will be recognized by their strong refractive power.

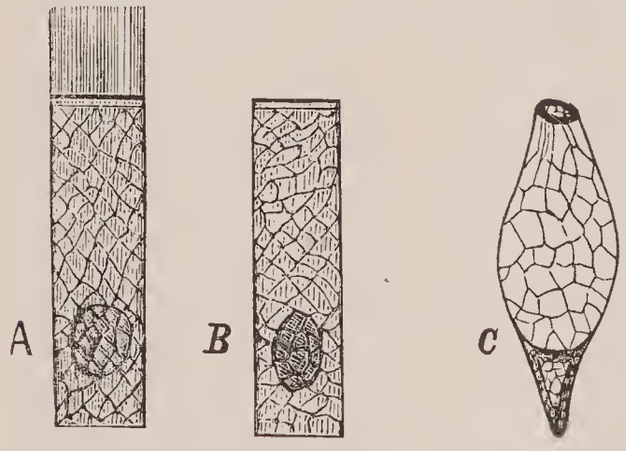
Columnar epithelium from intestine, with one "goblet cell." x 400.

A few cells may be seen of peculiar chalice shape, called "goblet cells." Sometimes these are found quite abundant, but usually they are scattered here and there between the cylindrical cells. The part of the cell nearest its free border has swoolen out owing to the conversion of its formed material into mucin. The contents of the cell, being hygroscopic mucin, swell up to an extent sufficient to burst through the free border, thus in normal conditions furnishing a certain amount of mucus. Frequently this structureless substance can be seen protruding from the rup-

tured end of a cell, in the very act of passing out of it. These cells must be regarded as normal structures undergoing mucous metamorphosis. Hæmatoxylin stains the mucous contents of these cells a deep purple-blue. Small pieces of the mucous membrane may be placed for forty-eight hours in a one per cent. solution of osmic acid. It is then thoroughly washed in water to remove the excess of the acid and the cells separated from each other as much as possible with needles. All parts of the cell now show to better advantage. Any fatty particles are colored black by the acid and the body of the whole cell is slightly stained as well. Cells prepared after this method can be permanently preserved in glycerine.

CILIATED EPITHELIUM.

Ciliated epithelinm may be readily obtained by gently scraping the mucous membrane on the roof of a frog's mouth. If a large amount be desired, the frog may be killed and this entire membrane dissected off. For ordinary purposes sufficient epithelium will be brought away with the mucus by scraping the membrane *in situ* with the point of a clean scalpel. A drop of normal saline solution should be placed on the centre of a glass slide and on either side of it a hair, in order that the cover-glass may not press upon the cilia and thus check their vibrations. The adherent mucus is then transferred from the knife to the salt solution. The preparation should be covered and examined at once with a power of at least 450 diameters. The cilia will be seen in active motion, driving any particles that come near them in one direction. If the cells are isolated or if only a few are in a group, the cilia will act like little paddles, causing the cells to whirl around and move about over the field. If there are no blood corpuscles or granules to be driven about, particles of carmine may be added to the specimen. This is best done by mixing a little granule of carmine with water and



A, Ciliated cell. B, Columnar cell. C, The columnar cell, B, changed into a goblet cell and filled with mucin. (After Klein and Smith.)

placing a drop at the edge of the cover-glass. Diluted with water, aniline red will tinge the cilia without causing their motion to cease. (Aniline red=Fuchin, 1 centigramme. Absolute Alcohol, 20—25 drops. Water, 15 cubic centimeters.) The action of cilia may be strikingly shown by examining the gills of a living oyster or of a clam.

The particle of mucus removed from the frog's mouth may be gently torn to pieces with needles, when many cells will become free and the motion and power of the cilia seen to good advantage.

Electrical currents, heat, and any fluid currents all accelerate the motion of the cilia. Carbonic acid first accelerates, then checks, and finally arrests their motion. When the motion has just ceased slightly alkaline fluids will apparently call it to life again for a short time. When the vapor of chloroform is brought into contact with the cilia while in vigorous motion the movement will become gradually slower and slower and eventually stop. If now fresh air be allowed to displace the vapor of the chloroform the cilia will revive and become as active as ever.

Ciliated Epithelium from trachea of a cat. x 450.

PAVEMENT EPITHELIUM.

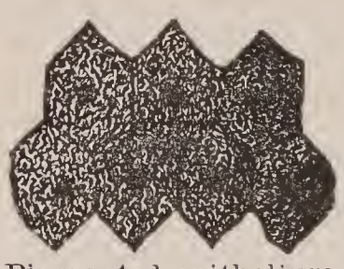
Pavement epithelium, known also as squamous or buccal epithelium is obtained by placing a drop of the saliva on the slide. The preparation is allowed to rest, without covering, for

Saliva. A, Epithelial cells. B, Salivary corpuscles. x 400.

a moment in order that the large number of air bubbles present may rise to the surface, when they may be removed by passing

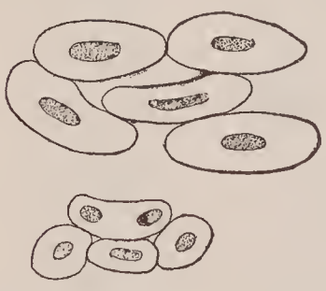
a needle horizontally over the specimen skimming them off. The specimen is now covered and examined with a high power. The cells are seen partly isolated and partly hanging together. They are very large, being from the $\frac{1}{450}$ to $\frac{1}{750}$ of an inch in diameter, and they are so transparent that it may be necessary to darken the field in order to render them visible. Each cell has a single nucleus that is quite small as compared to the whole body of the cell.

In addition to these large cells found in the saliva there are a number of smaller globular cells which resemble the white corpuscles of the blood. They are rather larger than the white blood corpuscles but are capable of exhibiting the same amœboid movements. They are to be regarded as white corpuscles which have either migrated from the blood vessels in the salivary glands and thus been carried to the mouth with the flow of saliva, or as corpuscles which have come from the mucous membrane lining the back of the mouth where are found large quantities of lymph corpuscles. The enclosed granules of these "salivary corpuscles" are capable of exhibiting the peculiar Brownian movement, seen also in the white corpuscles of the blood after the imbibition of water. The saliva very frequently contains many accidental ingredients, as starch granules, fibers from animal and vegetable food, and various fungous growths.



Pigmented epithelium, from choroid. x 400.

Stratified pavement epithelium is found covering the surface of the body, forming the epidermis. The most external of these cells are very irregular and broken and have no nucleus. The epithelial cells composing the nails, are separated from each other for study by boiling a thin paring of the nail in a 10 per cent. solution of soda, or the section may remain for a short time in a 27 per cent. solution of potash. The cells are closely united, are irregular in shape and enclose a round or lens-shaped nucleus.



Epithelium from the nail. x 400.

ASTIGMATISM PRACTICALLY CONSIDERED IN MICROSCOPIC WORK.

BY JAMES K. STOCKWELL M. D. OSWEGO N. Y.

AN article in THE MICROSCOPE of January, 1886, on "Astigmatism and its Relation to the Use of Optical Instruments," by Ernest Gundlach, was a remarkably clear and concise treatment of a common and annoying defect of the human eyes, and interested me greatly, as it undoubtedly did very many others of the numerous readers of that valuable journal.

It occurs to me that the subject of asymmetry of the human eye has been very lightly if at all touched upon by any of the various writers on optical matters, outside of authors of text-books on defects of vision and the use of spectacles.

Mr. Gundlach says, and very truly, that "Astigmatism is very common, and even the healthy eye is not entirely free from it." It is so common and so little understood that many people, even professional and other educated persons, who should be somewhat familiar with the common laws of optics, go through the world without knowing that certain lines are less clearly defined to their eyes than they should be, and there are other lines having different direction only, being otherwise similar. And if, perchance, they are conversant with the *fact*, remain wholly at a loss how to account for it, and so perhaps in time come to believe that their eyes are really no different from other and more nearly perfect eyes—emmetropic eyes, or those which in a state of rest (without any effort of the accommodation) bring parallel rays of light, in all meridians, to a focus on the layer of rods and cones of the retina and there form a clear and distinct inverted image of the point, line or object from which they come.

Astigmatism requiring a concave or convex cylindrical lens of more than one hundred or even seventy-two inches focal length for proper correction is usually too slight and unnoticeable to demand attention unless complicated by long or short sight; occasionally, however, even that slight degree of asymmetry gives rise to much discomfort, if to no other trouble, during prolonged and close use of the eyes.

Mr. Gundlach, for whose skill and ability I have great respect, either intentionally, to simplify his article, or else acci-

dentally, voices a common error and says, "It (astigmatism) is caused by a certain irregularity in curvature of one or both surfaces of the crystalline lens of the eye."

For the purpose of illustrating the relation astigmatism bears to the use of optical instruments, or to avoid entering into technicalities in definition, the foregoing statement may be, and probably is, sufficiently satisfactory; but writers and periodicals whose every utterance should be an advance step in matters appertaining to education and facts in science, cannot afford to rest their reputations on incorrect statements under any circumstances.

Astigmatism was first mentioned by Thomas Young* who considered it due to some inequality in the structure of the *lens*. Later Wharton Jones claimed that its seat was in the *cornea*. By recent investigators it is now held that the aberration due to a difference in the focal distance of the two principal meridians—usually the vertical and horizontal—most commonly depends upon a defect or asymmetry of the *cornea*. This is termed *regular* astigmatism and is readily remedied by cylindrical lenses, the other optical defects, such as myopia or hypermetropia, having been first corrected by the use of spherical lenses. The aberration which is due to a difference in the refraction in one and the same meridian, and sometimes in addition thereto in different meridians, is caused by irregularity in the *crystalline lens*, except when caused by opacities or scars the result of corneal ulcers, and is termed *irregular* astigmatism and cannot be corrected.

The highest degrees of astigmatism are usually found *after removal of the crystalline lens* by cataract operations and are then unquestionably due to asymmetry of the cornea, an unavoidable result of the cutting operation. This is almost invariably regular astigmatism, requiring for correction a convex cylindrical lens, frequently of eight to fourteen inches focal length, axis horizontal, in addition to the strong convex spherical lens necessary to replace in a way the removed crystalline lens.

Many of the disputes and disagreements between micros-

*Donder's Work, p. 539.

copists as to the exact shadings and markings of test and other objects, notably those having lines meeting or crossing at various angles, are possibly due to the fact that they are not seen through the same or optically similar eyes, and one being almost or practically free from astigmatism and the other having it developed to a much greater degree, thus making it utterly impossible for the observers to see alike.

The remedy proposed by Mr. Gundlach, viz: Eye-pieces with the eye-lens of an asymmetric or cylindrical form so as to correct or neutralize the asymmetry of the eye, is in harmony with his well known earnest efforts to improve and build up the science in which he is a workman of superior skill.

While the plan is quite feasible and very excellent in optical results, there are several and serious objections that may be mentioned.

The first, and perhaps most tenable one, is the fact that while the eye-piece would perfectly suit the person for whom it was made,—one eye at least—not another one in several thousand could use it unless it was so constructed as to admit of having the eye-lens, the asymmetric part, readily removed and replaced by a symmetrical one, and the optical results would not be commensurate with the trouble and expense involved.

Complicated combinations of spherical and cylindrical lenses, requiring plus and minus lenses of both kinds, ranging in focal distance from six inches in extreme to seventy or one hundred in mild cases, and skill and experience are necessary to correct astigmatism. How then can the ordinary microscopist bring order out of confusion by experimenting with *three eye-glasses?*

It would simplify and improve matters if the astigmatic were to have the formula for a lens neutralizing his asymmetry, for instance, thus:—36 cyl. axis 180°, sent to an optician and have made a small lens with a steting of thin brass so constructed as to slip on the top of the eye-piece, over the eye-lens and as close to it as possible. The slight details of convenient construction readily suggest themselves to the optician.

If the microscopist uses the eye-piece of one maker the accessory, for such it is, fits each and all of them as they are brought

into use and when not needed it may be easily removed, leaving the perfect eye-piece ready for use under the normal eye.

Many, in fact most, astigmatic persons have a different degree of defect in each eye, and therefore a better plan would be to have suitable cylindrical lenses put into *spectacle frames* and they worn only while using the microscope. These can be placed near the eyes, the axis of each is firmly held in its proper relation to the effective medium and each eye has before it the exact correction of that eye's asymmetry. To be sure this requires the aid of a skilled specialist; but once done there is no further trouble or anxiety. No feeling around with test-lines in order to be sure that the glasses are in the best position for work.

Secondary distortion because of being a little distance from the eye-lens of the instrument is not troublesome, nor worth considering as against convenience, comfort and the ability to instantly change eyes when working—an important desideratum.

The article, of which this may very properly be considered a feeble criticism, should arouse astigmatic microscopists to the importance of correcting their defective eye-sight, which, having done, will enable them to use their eyes with greater comfort than formerly, observe more correctly and perhaps find less fault with the performances of their objectives.

THE RELATIVE MERITS OF FILAR AND ORDINARY GLASS EYE-PIECE MICROMETERS.

BY M. D. EWELL, M. D., LL. D.

IN the June number of the *American Journal of Microscopy* for the present year is a short article by Mr. H. L. Tolman, giving the results of the measurements by himself and the writer of 75 human red blood-corpuscles, 50 of which were measured by Mr. Tolman with a Spencer $\frac{1}{10}$ and an ordinary eye-piece micrometer, giving a mean diameter of $\frac{1}{3139}$ inch and 25 by the writer with a Spencer $\frac{1}{10}$, Bausch & Lomb amplifier, and filar micrometer manufactured by Mr. Bulloch, of Chicago, giving a mean of $\frac{1}{3138}$ inch, from which Mr. Tolman drew the conclusion "that the cob-web micrometer does not offer sufficient

advantage in point of accuracy to compensate for its additional cumbersomeness and expensiveness."

Up to that time I had never made any comparisons of these two methods of micrometric measurement, other than the measurement of the blood-corpuscles above referred to, if that can be called a comparison; and, as Mr. Tolman habitually uses an eye-piece micrometer of the ordinary pattern ruled into spaces of $\frac{1}{100}$ inch, and is not accustomed to use the filar micrometer, while at that time I had had little experience with the use of any other than a filar micrometer, I have thought that the deductions drawn by him from a comparison of measurements of *different* objects were hardly warranted by the facts, and having thus had my attention drawn to the subject and not having seen anything in microscopic literature which to my mind satisfactorily settled the question, I have for some time past been working upon the problem and herewith present the facts and conclusions arrived at, which will, I hope, clear up a question which while not difficult, appears not to have received so much attention as it deserves.

The first step in order to compare the results of the two methods, obviously was to secure an accurate standard of comparison and accurately to determine the value of one division of each micrometer for each one of the objectives used in this work. This has engaged my attention for a very considerable period, and the values assigned to one division of the respective eye-piece micrometers are the mean of a very large number of measurements made at different times from different standards, whose relative and absolute corrections are well known, so that I feel confident that they are correct within exceedingly narrow limits. While I have never yet seen a micrometer whose subdivisions were exactly equal, I may state in passing that the micrometers manufactured by Prof. W. A. Rogers are so nearly uniform and accurate that values derived from means of series made from different micrometers at intervals of from one day to several months uniformly agree in fractions of an inch to the sixth, seventh or eighth decimal place, depending on the power used; and that the results thus obtained are identical with those obtained from the direct measurement of "Centimeter Scale A,

1882," to which I have recently had access. The above remarks apply to means of series of measurements of several different spaces, made with a filar micrometer with objectives ranging from one inch to $\frac{1}{20}$ inch. I would not be understood as saying that these measurements are accurate to the extreme limit indicated by the above figures, but only that the values of one division deduced from the different series agree to that extent. The extreme limit of accuracy in microscopic measurement is a subject upon which I am not yet ready to express a decided opinion.

Coming now to the particular tests used in testing my filar and ordinary eye-piece micrometer ruled on glass to $\frac{1}{1000}$ inch with every fifth and tenth line longer than the others, I took as spaces for comparison two spaces nominally of $\frac{1}{1000}$ inch on each of a Beck's and Fasold's glass stage micrometers, and 10 spaces of $\frac{1}{100}$ mm. on a standard centimeter ruled on speculum metal by Prof, W. A. Rogers, and made a series of from five to fifteen measurements of each space with a filar and an ordinary eye-piece micrometer, took an arithmetical mean and compared the results using a Zeiss 1", 3-5" and $\frac{1}{4}$" objective, as follows:

OBJECTIVE.	EYE-PIECE MICROMETER	1ST 1-1000 BECK	2d 1-1000 BECK	REMARKS.
		MIKRONS.	MIKRONS.	
C C (¼") Zeiss	Filar	25.29	25.45	Means of 6 measurements.
" " "	Filar	25.41	25.66	Means of 4 measurements.
		Means: 25.35	25.55	Difference .20 *m*.
" " "	Glass 1-1000 inch	25.04	25.09	Means of 5 measurements.
" " "	Glass 1-1000 inch	25.48	25.48	Means of 4 measurements.
		Means: 25.26	25.28	Difference .02 *m*.
A A (3-5") Zeiss	Filar	24.99	25.15	Means of 5 measurements.
" " "	Filar	25.01	25.19	Means of 4 measurements.
" " "	Filar	25.02	25.25	Means of 5 measurements.
		Means: 25.01	25.20	Difference .19 *m*.
" " "	Glass 1-1000 inch	25.73	26.17	Means of 6 measurements.
" " "	Glass 1-1000 inch	25.15	25.15	Means of 4 measurements.
" " "	Glass 1-1000 inch	24.08	25.47	Means of 6 measurements.
		Means: 24.99	25.26	Difference .27 *m*.
a a (1") Zeiss	Filar	25.14	25.29	Means of 10 measurements.
" " "	Glass 1-1000 inch	25.00	25.00	Difference 15 *m*. Means of 5 measurements, all alike. Difference 000.
		2d 1-1000 FASOLD	7th 1-1000 FASOLD	
a a (1") Zeiss	Filar	25.16	25.49	Means of 6 measurements.
" " "	Glass 1-1000 inch	25.00	25.00	Difference .33 *m*. Means of 8 measurements, all alike.
A A (3-5") Zeiss	Filar	25.26	25.53	Difference 00. Means of 6 measurements.
" " "	Glass 1-1000 inch	25.20	25.20	Difference .27 *m*. Means of 5 measurements, all alike. Difference 00.

The following table gives the means of five measurements with a Zeiss $\frac{1}{18}$ hom. im. objective, of each of the last 10 $\frac{1}{100}$ mm. of a standard centimeter on speculum metal, ruled by Prof. Rogers. The first set was made with an ordinary glass eye-piece micrometer, and the second with a filar micrometer. Both were made at one sitting:

		SPACES.										
		1	2	3	4	5	6	7	8	9	10	
1-18 Zeiss.....	Glass micr. 1-1000 1 div = .22 *m*	45.2 div 9.944 *m*	45.1° 9.922 *m*	45.7° 10.054 *m*	45.4° 9.988 *m*	45.0° 9.90 *m*	45.3° 9.966 *m*	45.1° 9.922 *m*	45.1° 9.992 *m*	45.3° 9.966 *m*	45.1° 9.922 *m*	Mean 45.2 div. 9.45 *m*
1-18 Zeiss.....	Filar 1 div = .0217 *m*	456.70 div 9.91 *m*	456.62° 9.808 *m*	462.46° 10.031 *m*	461.64° 10.018 *m*	456.36° 9.903 *m*	457.05° 9.918 *m*	460.44° 9.992 *m*	458.17° 9.942 *m*	460.74° 9.932 *m*	458.13° 9.941 *m*	Mean 458.83° 9.977 *m*

The following series were made from the same spaces of the same standard at another time but at one sitting with a Spencer $\frac{1}{10}$ hom. im. and Bausch & Lomb amplifier:

OBJECTIVE.	MICROMETER.	SPACES.										
		1	2	3	4	5	6	7	8	9	10	
1-10 Spencer with Bausch & Lomb Amplifier.	Filar 1 div = .02554*m* Glass 1-1000 1 div = .263 *m*	386.70 div 9.864 *m* 38. 9.994 *m*	387.27 9.891 *m* 38. 9.994 *m*	393.52 10.050 *m* 37.9 9.968 *m*	391.80 10.006 *m* 37.9 9.968 *m*	338.24 9.916 *m* 37.6 8.889 *m*	389.18 9.940 *m* 37.9 9.968 *m*	392.06 10.013 *m* 37.9 9.968 *m*	388.94 9.934 *m* 37.6 9.889 *m*	390.90 9.973 *m* 37.9 9.968 *m*	389.94 9.960 *m* 37.9 9.968 *m*	Mean 389.86 9.957 *m* Mean 37.86 9.957 *m*

—— *m stands for mikron.*

In both these series I have given the number of divisions of the micrometer as well as the value in mikrons.

In making all the above measurements with the glass eye-piece micrometer I always endeavored to estimate the fractional parts of one division; but candor compels me to state that these estimates were largely conjectural, in fact not much better than mere guesses, for the reason that the lines in the eye-piece ($\frac{1}{1000}$ inch apart) are so near to each other that with another line between them the eye cannot separate them sufficiently to estimate the proportional distance from the lines on

either side. This will account for the want of unformity in some of the series measured with the glass eye-piece micrometer. With the lowest power the series are uniform, for the reason that the difference could not be measured with so coarse an instrument. It would in the latter case be like attempting to measure a space of $\frac{1}{10000}$ inch with an ordinary carpenter's rule. With respect to the last two tables, the figures in the second decimal place indicating hundredths of a division, should properly have been omitted, and of course cannot be relied upon; but to avoid the labor of recasting the table I have inserted them with this explanation to prevent any one's being misled thereby.

From the above measurements I think it clearly appears that with low powers the glass eye-pice micrometer as compared with the filar micrometer, is a decidedly inferior instrument; but when used with a very high power so that each division represents only a small fraction of one mikron, it becomes in the hands of a skillful observer a very good instrument.

It may perhaps be objected to the above measurements that the disagreement between the different series made with a filar micrometer is an argument against its accuracy. To this objection I would answer that I am not in this investigation attempting to settle the absolute length of the respective intervals, but only to show the sensitiveness, so to speak, of the filar micrometer as compared with the ordinary eye-piece micrometer. This objection might be obviated by making the measurements more numerous, while no number of measurements, however great, will eliminate the accidental errors of an instrument so coarse as respects the spaces measured that the very small difference in the lengths compared cannot be detected by it, as is the case with the ordinary micrometer when used to compare lengths, which with the power used appear to be equal. The filar micrometer when well made is more accurate than the eye and with it a careful observer can by making a series of measurements easily detect differences of length which can not be detected by a careful observer with any eye-piece micrometer of the ordinary pattern however well made. Repeated trials make me quite confident of the truth of this statement; and in order to further test the accuracy of this conclusion by reference to

the work done by others, I have taken the second mm. of "Centimeter Scale A, 1883," which according to Prof. Rogers when defined by the central defining lines needs no correction, and compared it with the third mm. of the same scale, which according to Prof. Rogers is 0,36 mikron longer than the second mm., using a 1″ Zeiss objective, so as to bring the whole length fairly within the field. With the glass eye-piece micrometer the second and third millimeters seem to be of *exactly the same length*, or if there is any difference it is imperceptible, each covers exactly 197 divisions of this micrometer, and I was particular to use the same intervals in making the comparison. With the filar micrometer on the other hand, the difference was at once apparent, the 3d millimeter being perceptibly longer than the second at every measurement. I will not now say how much longer, for the reason that I have not made a series of measurements sufficiently numerous to warrant me in expressing a decided opinion upon this point, and for the further reason that the value of a division in each case was determined in the centre of the field and the value in the centre is different with all the objectives I have examined from that at or near the edge of the field. I adduce this solely for the purpose of showing that the filar micrometer will, with a low power, render apparent differences in length which the glass eye-piece micrometer will not. That this is so will not seem strange when we remember that the smallest divisions of the ordinary eye-piece micrometer are usually not less than $\frac{1}{1000}$ inch, while one division of most filar micrometers is much less. The pitch of the screw of my own is approximately $\frac{1}{2}$ mm. and the index wheel is divided into 200 parts, so that one division represents an absolute movement of the spider line of about $\frac{1}{400}$ mm. or $\frac{1}{10000}$ inch. By the aid of a lens I read each division to tenths. With the unaided eye it requires great accuteness of vision and much skill to estimate a fraction of one division of the glass micrometer. In fact, I do not think the average eye is equal to the task of doing it with accuracy under ordinary circumstances. Under favorable circumstances one division may be halved by estimation and may perhaps be divided into even smaller fractions, though such estimation partakes so largely of the character of a mere guess as to be of little value in precise measurements. I should say then that

with so fine intervals the limits of accuracy at the eye end of the microscope are little, if any, less than the value of one half of one division. With the filar micrometer there is no such embarrassment. The spider line can, when the definition is good, be brought into exact optical contact with the object to be measured, and the divisions read off without resort to estimation further than the fractions of one division of the index, and this is so large as not to involve any difficulty. If the definition of the objective is bad, it is easier to use the filar than the glass eye-piece micrometer, but of course, exact measurements will in that case be impossible with any micrometer. When the amplification is so increased by the use of high powers that one division of the ordinary glass micrometer represents a small fraction of a mikron, very good work may be done with such a micrometer, as we think will be apparent by examinining the foregoing tables.

With increased experience, my respect for low power objectives used with the filar micrometer in making micrometric measurements and comparisons has greatly increased. When an object is large enough to occupy an appreciable portion of the field e. g. $\frac{1}{1000}$ inch, I am inclined to believe that as good results in a series of measurements can be obtained with a low as with a moderately high power. At least such has been my experience. In measuring very minute objects or objects so small even as blood corpuscles, a power must of course be used that will give an amplification large enough to occupy an appreciable space in the field, but the instant the definition becomes defective and the edges "wooly," my experience is that better results can be obtained with a lower power that will give perfect definition.

The conclusions from the above tests are obvious. When the greatest attainable accuracy is not required, the glass eye-piece micrometer is the more useful and convenient and is accurate at least up to the value of one division or even less, if the distance between its lines is greater than $\frac{1}{1000}$ inch, or a higher eye-piece than one inch is used. I have, however, never found it advisable to use a deeper eye-piece than one inch with any objective.

To illustrate further: With a one inch eye-piece, tube-

length of 8.9 inches from lower end of nose-piece to upper end of tube, and a glass eye-piece micrometer with the lines $\frac{1}{1000}$ inch apart, the value of one division of my eye-piece micrometer is as follows:

1 inch Zeiss, 1 division	5 μ.
3-5 " " " "	3.36 μ.
1-4 " " (cov. correction 10°)	.98 μ.
1-4 " Bausch & Lomb, (opaque illuminator)	1.27 μ.
1-6 " Zeiss, (cov. cor. 10°,) " "	.714 μ.
1-10 " Spencer, (cov. cor. 1 rev. + $10\frac{1}{2}$°) with Bausch & Lomb amplifier, 1 div.	.263 μ.
1-18 inch Zeiss, 1 div.	.219 μ.

From this table it appears that with the one inch Zeiss, a difference of from 2.5 μ. to 5 μ. is the smallest that can be detected, and when variations of focus are taken into consideration, which with so low a power is a very important factor, I should be inclined to place the limit considerably higher than the lower figures above quoted. With very high powers on the other hand very much better work can be done with the glass eye-piece micrometer as will be apparent from the above tables. Yet even here, owing to the fact that the edges of lines ruled on glass or metal, or the outlines of blood corpuscles are not so sharply defined as with the lower powers. I am inclined to think that with such a micrometer it would be doing extremely well to be sure of accuracy at the eye end of the instrument to within one whole division.

The value of one division of the filar micrometer above described with the above objectives is as follows:

1 inch Zeiss, 1 div.	.4923 μ.
3-5 " " " "	.329 μ.
1-4 " " (cov. cor. 10°) 1 div.	.096 μ.
1-4 " Bausch & Lomb (opaque illuminator) 1 div.	.126 μ.
1-6 inch Zeiss (cov. cor. 15°)	.0684 μ.
1-10 " Spencer	.04 μ.
1-10 " " with Bausch & Lomb amplifier	.02554 μ.
1-18 " Zeiss	.0217 μ.

As I before remarked the filar micrometer is more perfect than the eye; so that as every one knows it is by no means possible to make all or any considerable number of a series of

measurements exactly alike, yet I think I speak within bounds when I say that with low powers it is, at the very least, ten times as accurate as the eye-piece micrometer, and when the mean of a series is taken, there is in my mind no doubt whatever that it is much more reliable. I think it would not be difficult to demonstrate this. I had intended to apply the method of least squares to the elucidation of this question, but so far as the limits of accuracy of the microscope are concerned, the work has already been done much better than I can do it by Prof. Rogers and Prof. Morley in a paper upon the subject published some years since in the (then) American Quarterly Journal of Microscopy. Moreover, while the results obtained by the filar micrometer with any power might be tested by this method, the results obtained by its application, for instance, to the comparison of the 2d and 3d m. m., of Scale A, with the glass eye-piece micrometer above referred to, would be fallacious in the extreme; for as every measurement with the glass eye-piece micrometer with this power would be absolutely identical there would be no residuals and no probable error. Notwithstanding this, there might be an error in any measurement of 2 or 3 mikrons which this instrument would not make apparent. When a power is used sufficiently high to disclose the difference of length this objection would not apply.

The conclusion of the whole matter, therefore, is that for the comparison of lengths nearly equal and for the measurement of minute distances with low powers, the glass eye-piece micrometer is vastly inferior to the filar micrometer; and that in cases where the greatest attainable accuracy is required, as for example in the measurement of blood corpuscles in criminal cases nothing but the filar micrometer should be used. I shall have something to say about the much inferior method of measurement by means of the camera lucida at some future time.

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A BLACK GROUND FOR OPAQUE MOUNTS.

W. C. BRITTAN.

THE following receipt for a paint that will give a dead black surface as required for the inside tubes of optical instruments, etc., should be in the hands of all who work with the microscope: Take two grains of lampblack and add three drops of gold-size, mix thoroughly and add twenty-four drops of turpentine, when again thoroughly mixed it is ready for use. Apply it thin with a camel's hair brush. When dry the articles will have as fine a dead black as when they come from the opticians hands. This paint will also be found just the thing where a dead black ground is required for opaque mounts.

EDITORIAL NOTES.

DEATH OF DR. W. B. CARPENTER.—We had hoped to give our readers a proper notice of the death of this eminent scientist; and simply because this notice has been delayed is not from any want of appreciation of his work. We never had the pleasure of meeting Dr. Carpenter, and we know only too little of his life and work, except as might be portrayed in his works dealing especially with microscopical and physiological subjects. It has been our endeavor to get some person who knew him well to write a sketch of his life and labors; but in this we have failed and now at this late date we can simply say that he leaves an example worthy our imitation; a life made of one long workday. He once wrote that he would feel well rewarded for his labor "if it should tend to direct the student to more systematic labors in those fertile fields which only await the diligent cultivator to bear abundant fruit; for," he adds, "the inexhaustibility of Nature is constantly becoming more and more apparent."

MR. E. H. GRIFFITH wishes to thank those members of the American Society of Microscopists who have sent their cabinet photographs for the society in answer to his cards of solicitation. It is his desire to see a good photograph of each member of the society in the hands of its custodian and he hopes that those who have not already sent theirs will do so before the next

meeting. They should be sent to Geo. E. Fell, M. D., Buffalo, N. Y.

THE editor of the *Indiana Medical Journal* is expressive to say the least. Under the title "Monkeying with the Microscope" he proceeds to give his medical readers some sound advice. He calls the attention of those who purchase a microscope for the purpose of "furnishing the office" and tells them that they waste their time and money. Another fallacy is in the mounting of scores of slides. This should not be done he says, "unless for recreation or as a hobby." He suggests that the busy practitioner buy his mounted slides of some well-known specialist, and that he spend most of his time set apart for microscopical work "in studying the microscope for all it is worth as a means of diagnosis." The editor says he would not rail at scientific investigation but "an amateurish dilletanteism which saps the mental and physical activities, and locks out and keeps from the doctor that which his patients need and pay for." He would have the busy practitioner put his microscope on a par with the test-tube, the clinical thermometer, the stethoscope, and the exploring trochar. Each physician should have a microscope and then use it.

SOME of our readers may remember how a certain editor, —"anxious to pose as the champion of pure science," as *The National Druggist* designated him under the title of "A Savant and a Snop,"—tried to strangle our youthful aspirations by calling us a "serio-comic journal" and the like. But listen, the last number of the Journal of the Royal Microscopical Society speaks of the account given of the Cleveland meeting by said editor in his journal for October. as "*A serio-comic account.*" Alas, how low have the mighty fallen.

Personally, however, we thought the account was a first-rate one, believing that it is possible to make a journal contain interesting reading at least once a year.

QUERIES.—Mr. W. H. Bulloch propounds the following questions for microscopists to answer:

First. What is the magnifying power of an inch lens at ten inches between the object and lens?

Second. What is the formula of a two-inch eye-piece as used in the microscope, not in the telescope?

Third. What is the magnifying power of a two inch eye-piece ten inches between the object and diaphragm?

Fourth. Are there fifty microscopes in this country furnished with two inch eye-pieces?

Fifth. What is the length of a ten-inch tube?

Mr. E. Gundlach answers the first, 7.9 diameters. The third he answers, "just six diameters," and also says that the magnifying power of an eye-piece is not varying with the distance of the object. To the fifth he facetiously answers, "ten inches I should think." This last reply reminds us of a question we heard asked at a depot recently, "what time is the four o'clock train due?" Or another, "what is the price of your ten cent sugar?"

REPUTATION.—It is not a very difficult thing to acquire notoriety in almost any line of work. For proof of this one has only to read a single article of Dr. Rollin Gregg's of Buffalo; but additional proof comes from the pen of a "microscopist" who writes to the *Medical Bulletin* that "the best test of a fine section is the ease with which it floats in a glass of water. Those sections which sink are too thick for mounting, as a rule." He evidently never heard of such a thing as "specific gravity;" perhaps he never performed that wonderful feat of our boyhood and made a needle float on water! Yet it occurs to us that a needle is rather too thick for mounting; as also a cork, or a piece of lung tissue. In a word this "best test" is just no test at all, as everybody knows, or ought to know, who has worked three weeks in practical histology.

DR. A. Y. MOORE sends us another slide. It is not a slide of double-stained blood corpuscles; nor a microscopic Geissler tube; nor silver plated diatoms; but a slide of *gold-plated* diatoms, the *isthmia nervosa*.

WE may soon expect to see other numbers of the *Journal of the New York Microscopical Society*. N. L. Britton, Ph. D., of the Columbia School of Mines, will be the editor.

REVIEWS.

GRAY'S BOTANICAL TEXT-BOOK. Volumes 1 and 2. Edited by Asa Gray, LL. D., Harvard University. Published by Ivison, Blakeman, Taylor & Co., New York. Sixth edition.

Volume one is mainly devoted to Structural Botany on the basis of morphology. The intimate structure, development and function are treated only so far as is necessary to the understanding of the morphology of the stem, leaves, etc.

Volume two is devoted to a consideration of the microscopic structure. the development, and the functions of flowering plants. Considerable space has been devoted to the appliances and methods relating to the technique of Vegetable Histology. Practical exercises are also given, and the student is urged to perform them in order to see the results of these special methods. The minute structure of the root, stem and leaf is given in clear language, and well illustrated with good drawings, nearly all of which are entirely new.

The structure of the flower, fruit and seed is also given, thus making a complete treatise on Vegetable Histology.

Prof. Goodale, of Harvard, is the author of this volume of the series.

Our readers interested in Botany cannot afford to remain without these volumes and especially the volume last mentioned.

LOUIS AGASSIZ; HIS LIFE AND CORRESPONDENCE. Edited by Elizabeth Cary Agassiz. Two volumss. 8vo. 400 pages each volume. Second edition. Published by Houghton, Mifflin & Co., Boston. 1886.

Doubtless every reader of this journal is familiar with the name of Agassiz; many of them have perused his "Methods of Study in Natural History," "Geological Sketches," etc. A few only of our readers ever had the privilege of a personal acquaintance or association with this great man. The volumes before us give a full account of his writings and works, and contain copious selections from his correspondence. It is the most extended biography of him which has ever been published. The work is written in most charming style and reads, in many parts, like a novel, so strange is the story of this intellectual

life. It is not a dull account of dry facts, letters and journals; but rather is it a narrative of a life marked by rare coherence and unity of aim; a life that cannot fail to stimulate and encourage others. It is a work that any of our readers will be delighted to read.

MICROSCOPICAL TECHNOLOGY. By Carl Friedlaender. Translated by Dr. S. Y. Howell, of Buffalo, N. Y., and published by G. P. Putnam's Sons, New York, 1885. Small 8vo. 250 pp.

In our December issue we reviewed this same work translated and published by different parties.

Both editions claim to be "translated with the permission of the author from the second enlarged edition." The work contains methods of preparing tissues and fluids, and an account of reagents used in general work. If two such large houses are to push the same treatise on some microscopical subject it is to be regretted that the treatise is not more worthy of their hire than the one before us. This is good so far as it goes, but is elementary and limited in character.

AMERICAN MEDICINAL PLANTS. By F. C. Millspaugh. Published by Boericke and Tafel. New York and Philadelphia. Fascicle III.

This is the third time we have had the pleasure of noticing this valuable addition to our Materia Medica. The plants are all drawn and colored from nature, by Dr. Millspaugh, and the lithographers have reproduced the plates with fine effect.

It must be an expensive undertaking for the publishers, and it is to be hoped that our American botanists, and all interested in medical plants will give them ample support. They certainly deserve it, as does the hard-working author.

ESSENTIALS OF VACCINATION. By W. A. Hardaway, M. D. Small 8vo. pp. 150. 1886. Published by J. T. Chambers & Co., St. Louis, Mo.

The author gives us a compilation of facts relating to vaccine inoculation and its influence in the prevention of small-pox. Abnormal complications and modifications of vaccinia; re-vaccination and many other interesting subjects are discussed. The author believes that persons should be re-vaccinated as often as there is any danger of infection, "even if a few months only had elapsed from the date of the previous inoculation;" and that as often as once every five years anyway.

THE POPE MANUFACTURING CO.

Among the beautiful calendars for 1886, we would especially notice the one telling us of the Columbia Bicycle.

VICK'S FLORAL GUIDE for 1886.

A STUDY OF THE MICROSCOPICAL APPEARANCES OF CYSTIC DEGENERATION OF THE CERVIX UTERI. W. P. Manton, M. D., Detroit.

PRIMARY PHENOMENAL ASTRONOMY. By F. H. Bailey, Northville, Mich. pp. 100. Price 25 cents. 1886.

THE HARVARD UNIVERSITY CATALOGUE. 1885–86.

TRANSACTIONS OF THE MEDICAL SOCIETY OF THE STATE OF PENNSYLVANIA, May 1885. Vol. XVII.

THE CENTURY.

This magazine for February opens with a full page portrait of Gen. Geo. B. McClellan. The series of "War Papers" contains an article from "Personal Memoirs of U. S. Grant;" "Our March Against Pope," by Longstreet; "Anecdotes of McClellan's Bravery," and also several memoranda. A large number of authors write "open letters" on "international copyright." Geo. W. Cable contributes "The Dance in Place Congo." This number contains also the first chapter of Howell's new serial, "The Minister's Charge." There is a large amount of interesting reading besides the above, all of which makes their "mid-winter number" a very instructive and entertaining one.

A rapid, though not a very neat, method of mounting with glycerine is one suggested, if I remember rightly, by Mrs. Louisa Reed Stowell, the accomplished junior editor of the MICROSCOPE, and one of the faculty of the University of Michigan. No preliminary cell work or ring is needed. The object is arranged in place upon the slip, and a very minute quantity of glycerine is used, so that when the cover-glass is applied the rim of fluid does not extend quite to the edge of it. The cement is applied in the usual way, and runs in under the cover-glass until it comes in contact with the mounting fluid. I know nothing personally of the durability of slides thus made, though when the work is carefully done the slide looks tolerably well. The one great advantage of this method is the rapidity with which mounts can be made and finished.—*F. L. James in Nat. Drug.*

THE CORPSE PLANT.—Every one familiar with our northern woods has seen the curious Indian Pipe or Corpse plant, Monotropa uniflora. It has acquired the latter of its two common names from its whiteness, stem, leaves, and floral envelopes, all being colorless and entirely destitute of chlorophyll. It has heretofore been regarded either as a parasite or saprophyte, but from the investigations which Kamienski has given to the European form, Monotropa hypopitys, it seems probable that both of these views are incorrect. The roots were examined and found not to possess the peculiar hausteria or sucking organs of parasites. Moreover, it was ascertained that the root cells which were in contact with the soil were dead and incapable of absorbing nutriment from it. But closely adhering to and enveloping the roots was found the mycelium of a fungus. This branches freely and forms a pseudo parenchymatous envelope often two or three times the thickness of the epidermis itself and is best developed at the apex of the root. This mycelium does not penetrate into the living cells, though occasionally its branches pass between them. It cannot therefore be properly regarded as a parasite on the plant. This fungus he finds is invariably present and is necessary to the life of the Monotropa, and he believes the plant derives its nourishment from the soil through the medium of the fungus mycelium. He regards it as an instance of symbiosis, such as commonly occurs among low forms of animal life.

THE STUDENTS' MANUAL OF HISTOLOGY.—"This is a very excellently illustrated manual. Dr. Stowell has certainly written a very good book. It is couched in simple, intelligible language, and is an excellent exposition of the position of histology to-day."—*Med. and Surg. Reporter.*

"This volume is replete with information, and alike acceptable to both student and practitioner. In general arrangement it is admirable. It is clear and explicit in its descriptions and is filled with interesting points of technique."—*Albany Medical Annals.*

"Prof. Stowell is certainly master of his chosen branch and the profession is greatly indebted to him for this work."—*Mo. Med. Journal.*

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

I HAVE Zentmayer's improved centennial microscope binocular, including all improvements to date. Same as new. Cost $550. will sell for $400. A. G. FIELD, Des Moines, Iowa.

WANTED—One copy of Vol. I., No 1 of Phin's Journal of Microscopy. Will give a well mounted and interesting microscopic object. M. S. WIARD, New Britain, Conn.

ONE-TENTH immersion, adjustable obj. by Gundlach, for sale.
HAROLD PLOWE, 136 High st., Peoria, Ill.

FOR EXCHANGE—A Hartnack 1-11 objective, 170°. Will exchange for a good low power glass.
A. Y. MOORE, 67 Euclid Ave., Cleveland, Ohio.

FOR EXCHANGE—One Fiddian Microscopic Illuminator, one Brass injecting Syringe with four pipes and stop cock, one Microtome (Brass) Rivet, improved, with knife, one Dr. Seilers Section Knife and Carrier, one warm Stage with Thermometer and Gas Chamber in exchange for first class Polariscope with goniometer Eyepiece or collection of thin mounted Rock sections.
DR. HENRY FROEHLING, 17 South 12th street, Richmond, Va.

FOR EXCHANGE—Zeitschrift fur wissenschaftliche Mikroskopie, Volume I., 1884. Would prefer type-slides of diatoms in exchange. Address,
A. B. AUBERT, Orono, Penobscot County, Maine

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg. Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

EXCHANGE.—Parties having diatomaceous earths or other microscopical material, prepared or crude, for exchange, please communicate with M. A. BOOTH, Longmeadow. Msss.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

PLEASE announce that I will supply labels, cards, and other first-class printing in exchange for good slides. EUGENE PINCKNEY, Dixon, Ill.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

I WILL SEND a quantity of good diatomaceous material containing Bacillaria Paradoxa—all living—in exchange for well mounted slides. JAS. C. LATHROP, Bridgeport, Conn.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W, WESTOVER, M. D., St. Joseph, Mo.

THE MICROSCOPE.

VOL. VI. ANN ARBOR, MARCH, 1886. No. 3.

ORIGINAL COMMUNICATIONS.

HOW TO MAKE PHOTO-MICROGRAPHS.

THIRD PAPER.

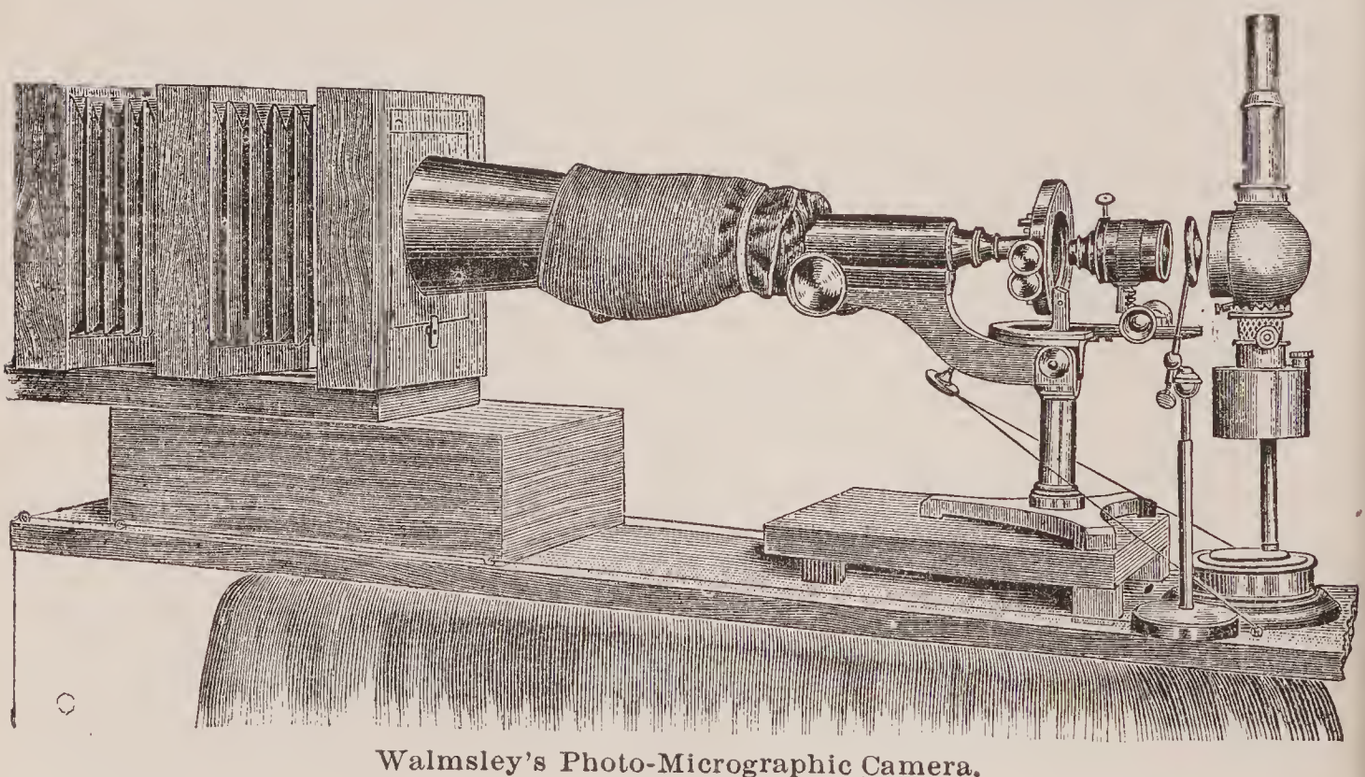
W. H. WALMSLEY.

We now come to the form of Camera devised by myself, and which is in daily successful use by many of our leading workers throughout the country. The instrument in its present form is simple, compact, and most perfectly adapted to every description of Photo-Micrographic work, with high or low powers. It is substantially constructed of mahogany; the body being square, and carrying a single dry plate holder, which permits the use of plates $4\frac{1}{4}$ x $5\frac{1}{2}$ or $3\frac{1}{4}$ x $4\frac{1}{4}$, vertically or horizontally, as may be necessary. The focusing screen, (of finest ground glass,) is hinged at the bottom, and held in position on top, by means of a spring catch, which also secures the plate-holder in place. To the centre of the screen a circular disc of thin microscopic covering glass is attached by means of Canada Balsam, the use of which will be explained further on. The front of the camera is removable, and carries either a board to which a lens may be secured for ordinary photographic purposes, copying, etc.; or a short cone to receive the tube of the microscope. The bellows are in two sections, with a centre division of mahogany, and a total extension of two feet; which is sufficient to give a range of magnification from 100 diameters to 230, with a one-fifth inch objective; and a corresponding range with any other power. The bellows slide smoothly upon V shaped ways, and are secured at any desired point, by means of a cam, operated by a lever, convenient to the hand. For greater portability, and also for convenience when using powers requiring only a short extension of the bellows, the frame upon which

they slide is made in two sections, which can be readily and firmly united by means of stout thumb screws. A scale, divided into inches, is attached to this frame work, so that the length to which the bellows are extended can be seen at a glance, an arrangement of great convenience in ascertaining the magnifying power employed, as will be explained hereafter. A female screw is firmly attached to the under side of the camera for securing the latter to the platform carrying the microscope and lamp.

This platform is usually a board from three to four feet in length, and ten inches wide, upon one end of which is a raised portion to which the camera is attached. The height of this raised platform, is regulated entirely by that of the microscope. When the body of the latter is inclined to a horizontal position upon the platform, the camera must be placed at such a height, that the centre of its cone and that of the tube of the microscope shall exactly correspond. In the accompanying illustration, (taken from a photograph,) the microscope is seen mounted upon a little supplementary table, rendered necessary from the platform having been originally made for use with a much larger microscope, the horizontal tube of which was on a level with that of the camera when the microscope stood direct upon the table of the platform.

By carrying Camera, Microscope and Lamps upon the one



Walmsley's Photo-Micrographic Camera.

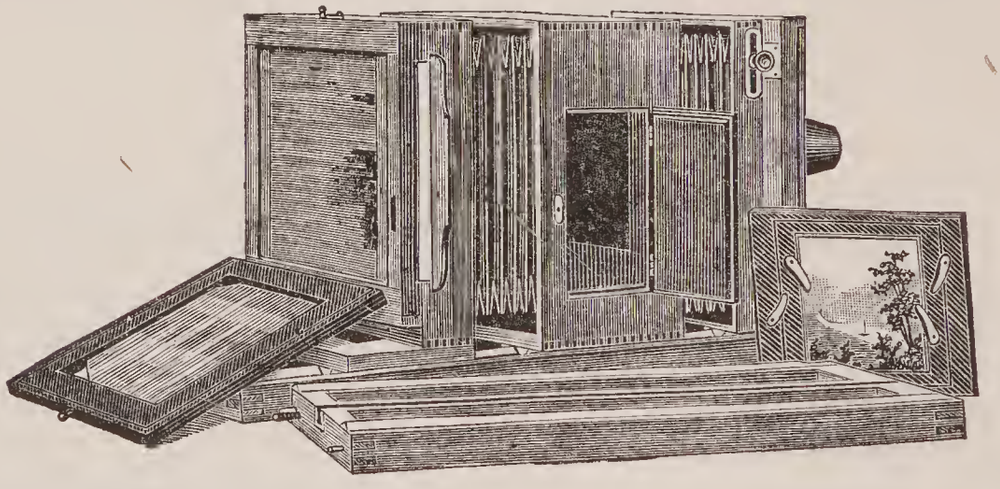
solid platform, any tremor or movement, caused by passing vehicles or other disturbances is communicated to object and image alike, producing a perfectly sharp negative.

When the tube of the microscope is inserted into the cone of the camera, the entrance of extraneous rays of light through the intervening space, is prevented, by wrapping a strip or sleeve of black cloth or velveteen, about the joint and securing same in position with a rubber band. With the bellows closed, all portions of both camera and microscope are brought into such close juxtaposition, that the manipulations of arranging, focusing, and illuminating the object, may be readily performed whilst the eye observes the image of the latter upon the focusing screen. But when it becomes necessary to extend the bellows, to increase the power, it will be found impossible for the hand to reach the various milled heads when the eye is in the necessary position for seeing the image upon the screen. If the image be properly centered with the bellows closed, it will remain so, even if they be extended to their utmost capacity; but the *focus* will *change*, requiring the objective to be placed nearer to the object upon the stage with every inch that the bellows are lengthened. Some device whereby the fine adjustment may be controlled from the extreme back of the camera-frame becomes necessary. That which I have adopted possesses the merits of simplicity and effectiveness. A groove is turned in the periphery of the milled head controlling the fine adjustment, around which a cord is passed and carried through hook eyes on either side of the camera to the rear thereof. A couple of leaden weights attached to the ends of this cord serve to keep the same taut, whilst the slightest pull upon either, moves the adjusting screw with the utmost nicety. A fine fishing line is admirably adapted to this purpose, the arrangement of which is clearly shown in the accompanying illustration.

Any good kerosene or petroleum burning lamp may be used as the illuminating agent, if means are provided for maintaining the flame at the proper height for the optical centre of the microscope. A German student lamp is admirably adapted to this purpose as the flame may be raised to any desired position above the table, and fixed by means of a thumb screw. Fiddian's Illuminator, (shown in the illustration,) is also perfect

in performance, though somewhat expensive. In my own practice, a lamp with large flat reservoir containing a large quantity of oil, and using a duplex burner is employed. This is carried upon a heavy retort stand, which allows the lamp to be placed at any desired height above the platform and secured there by means of a thumb screw. The edges of the flames are turned toward the stage of the microscope, and by means of a bulls-eye condenser on stand, (as shown also in illustration,) a very brilliant illumination of the object may be obtained. Indeed so powerful an amount of light is thus concentrated upon it, that I never employ any further substage or achromatic condensers with powers under $\frac{1}{6}$th or $\frac{1}{8}$th inch; whilst for those under one inch, no condenser at all is used, the direct rays from the lamp, (reduced by means of the sub stage diaphragm,) giving better results than are obtainable by the use of a condenser; although requiring rather lengthened exposures.

The form of camera, just described, is adapted only to the making of negatives. Quite recently I have improved upon it with additions that render it a complete enlarging, reducing and copying camera, whereby lantern slides of the best quality may be made from $\frac{1}{2}$ sized negatives, much better than by contact printing. The accompanying illustration and a brief description will clearly show the construction of this improved box.



Walmsley's Photo-Micro Enlarging, Reducing, and Copying Camera.

In all respects this improved camera is the same as that just described with the following additions. To the middle division of the bellows, a board is attached by a turn-buckle, which carries a rectilinear photograph lens; access to which is obtained by means of a light-tight door in the box, (as shown in the illustration.) This portion of the bellows body may be

clamped at any desired point upon the sliding framework, independently of the rear part which carries the focusing screen; an indispensable feature in securing the exact enlargement or reduction that may be necessary. The front of the camera is fitted with a double shifting arrangement, (vertical and horizontal,) for exact centering of the negative, which is firmly held in position by spring clips, and is provided with kits whereby quarter or half plates may be used as desired. The practical use of this apparatus in making lantern transparencies will be fully explained in a later article.

The camera and its component parts having now been described, and presuming my readers are provided with a microscope of some kind, it will be my pleasant duty in the next paper to unite these two important factors in the production of a photo-micrograph, and to explain clearly as possible how the latter may be made by any one willing to exercise a little care and patience. Comparatively few and inexpensive appliances and materials, other than those heretofore named are needed. Sensitized plates of course, a non actinic lantern, for placing same in the holder, and for development, a few flat dishes and chemicals, which will be duly named, include all the requisites for the work. It is merely a matter of simple chemistry, of brains and of patience; and the results are worth all the painstaking required and more too.

STRAY NOTES ON SOME FRESH-WATER INFUSORIA.

D. S. KELLICOTT.

ON looking over some notes made during the past summer I find several references to encysted forms and developmental phenomena. Some of these present features differing in so interesting a manner from recorded examples that I have thought an account of them worth the space it will occupy in THE MICROSCOPE and submit the following for the judgment of others.

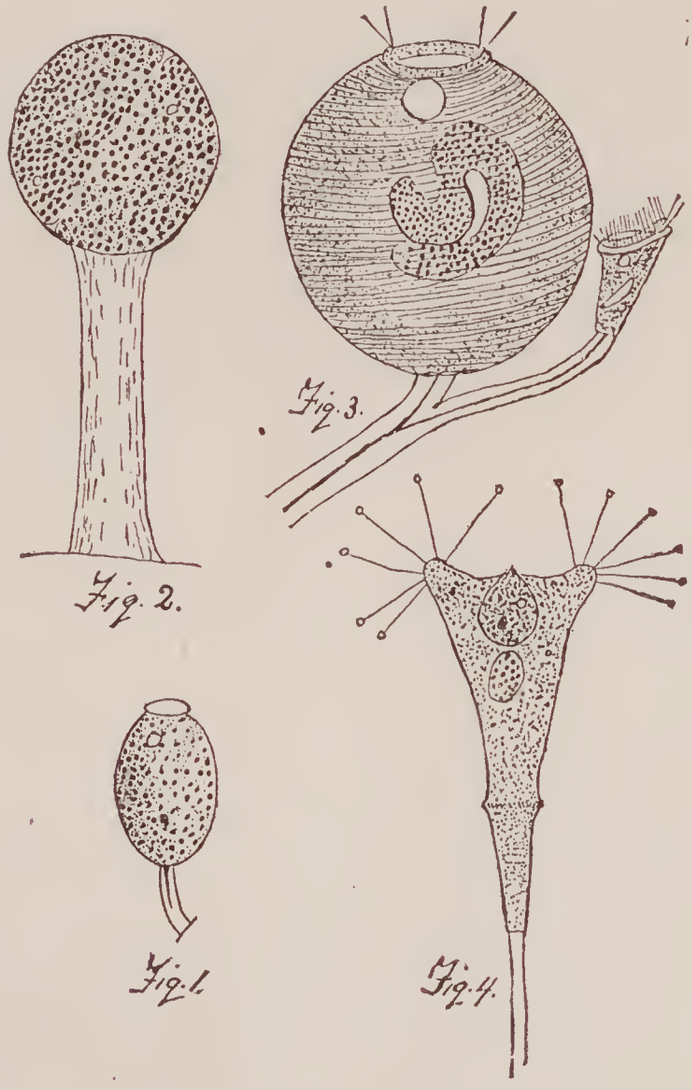
The encystment of minute animals, for example, Rotifera and Infusoria, is an act which, when understood and its results considered, is truly wonderful. For a long time we were told by authority, and few disputed it, that rotifers could be desic-

cated completely and, on applying moisture, they would again rise from their dryness to perfect form and activity. A more careful experimentation, however, led to the more reasonable conclusion that a rotifer, deprived of moisture, is destroyed; it was found that the drying up of the water containing the individual must be gradual in order to an apparent rising from its ashes; that under such a condition a cyst was formed by a gelatinous excretion from the animal's body which was absolutely impervious, hermetically sealing up the rotifer, moisture and all; its activity nearly or quite ceased and it could resist summer heat and drought or winter cold. It, in some way, was able to quickly free itself on the return of favorable conditions.

In the same way Infusoria protect themselves when the ponds and streamlets disappear in summer; thus it is that they are distributed as dust by winds, other natural means and accidents, so that every bit of water allowed to stand exposed to the air dust for a few days becomes the home of a few or many species. This protective encystment should not, however, be confounded with what has been called "duplicative" and "sporular" encystments in which the self imprisoned infusorian subdivides into two individual infusorians, similar to the original, or, into many sporular bodies which, after a longer or shorter resting stage develop into the adult form. Examples of protective and duplicative encystment will be referred to at some length below.

In the spring of the year every forest pond and wayside pool swarms with Entomostraca, and among these *Cyclops* especially bears the most bewildering number of short stalked vorticellids. I have thus far failed to satisfactorily identify them and have again and again given them up as an odd lot. One of this interesting collection I had, for some time, felt sure was a representative of the genus *Rhabdostyla* as defined by its proposer, W. S. Kent, but on further examination it was discovered that its short pedicle, instead of being rigid, possessed a rudimentary muscle and was, consequently, flexible at the upper part, so it was not a *Rhabdostyla*, nor did it appear to be a typical *Vorticella;* here I rested. Since then Prof. G. Entz's account of *R. sertularium*, Kent, under the title *Spastostyla sertulariarum* has been received and it helps to clear up matters.

(See Mitt. aus der Zool. St. Neap. 5–416, 1884). The present species clearly belongs near *Sp. sertulariarum* as does *Vorticella brevistyla*, d'Udekem (Entz) and *Vorticella rhabdostyloides*, Mihi. (Proc. Am. Soc. Mic., Cleveland Meeting, p. 43). Whether they should be placed in a separate genus, *Spastostyla*, or whether they constitute a distinct group of *Vorticella* I can not of my own knowledge form an opinion. The present species is, I think, undescribed. I expect to study it further on its return the coming spring. As spring is passing into summer vast numbers of them become encysted; such numbers of them have been seen on *Cyclops* as to render their color perceptible to the eye as their hosts were swimming in the collecting bottle. These cysts are oval or nearly spherical, at first colorless, then brown; the surface is ornamented with numerous elevations or bosses; at the upper pole is a ring raised above the surface. (Fig. 1).



Before the cyst begins to form the zooid's body enlarges considerably, the peristome and ciliary disc are then retracted

and the cystic walls begin to form. I have no doubt but that these cysts finally fall to the bottom and remain in the dry earth until autumn or the following spring.

Another cyst (fig. 2) is of common occurrence, more particularly on the immensely thick pedicles of *Opercularia rugosa*, Mihi. It is probably that of a ciliate iufusorian as it is similar to that of *Amphileptus meleagris* which is also common in the same locality, occurring most frequently on *O. nutans*. The history of the latter cyst is as follows: The predatory *Amphileptus* first makes a meal of the helpless vorticellid, then encysts itself, usually at the extremity of the stem which bore its sweet morsel. The rotation of the inclosed animal may be readily seen through the hyaline shell which is ornamented with striæ seen readily under a $\frac{1}{4}$ in. objective. After self division there escapes two ciliate forms, like the original, except in size. The first mentioned of these cysts, which Claparéde suggests is for protection from external injuries during digestion, differs from that of *Meleagris* in size and in the smooth shell. The contents are yellowish green, granular and may be readily seen alternately turning from left to right and right to left. An example under examination one evening showed a slight constriction, the same at 2 p. m. the next day had nearly completed the act of separation; the final escape of the new individuals was not witnessed, nor has the species been identified. I feel confident that it is not *A. meleagris*.

It cannot excite surprise that these cystic forms were for a long time mistaken for developmental stages of the stalked vorticellids with which they are found thus intimately connected.

I note a third and very different infusorial cyst which in purpose may not be very far removed from the foregoing. It was found to occur in June on an alga from a swamp; it was small, globular, mounted on a short stem, nearly straight. Surrounding the globe were three prominent rings in the places of the equator and tropics of the earth. The finely granular, quiescent animal could be seen within the hyaline shell and an occasional pulse of the vacuole witnessed. It was regarded as a cyst of some one of the Tentaculifera and was compared with

that of *Podophrya fixa* from which it differed in shape and ornamentation.

Doubtless, all who have even casually examined infusorial life have observed that certain zooids of the stalked species, when not suited with surrounding conditions, retracted their peristomal region and developed a posterior circlet of cilia, that after a longer or shorter time they loosed from their anchorage and swam away to establish themselves in more congenial quarters and grow a new pedicle and, if a compound variety, a new colony. In some species of the genus *Zoothamnium* the migrating zooids which are to found new colonies become abnormal and often greatly enlarged. I have occasionally met with the abnormal zooids of *Z. arbuscula* and the accompanying figure 3 represents such before it has developed the posterior cilia or even withdrawn the anterior cilia. It will be seen that the nucleus is greatly enlarged, more coarsely granular and coiled, the cuticular surface coarsely aud transversely striate. I estimate that the bulk of the spherical one is forty times greater than that of the normal form.

The act of binary division is frequently seen by those observing Infusoria, but that of internal budding or the internal production of ciliate embryos is less frequently witnessed. In the Tentaculifera it is not rare, if one recognizes the fact when presented. One day in July last a gathering of pond weeds and small aquatic animals was brought in on which *Podophrya quadripartita* was abundant, and the form most numerous was the elongated variety. Among these many were found with embryos occupying the upper part of the body cavity. This afforded an opportunity to observe the manner of escape of the embryos and to endeavor to witness the remarkable change in the nucleus attested by Bütschi, viz: "At the time of partition the endoplast exchanges its customary granular structure for a striate or fibrillate one, assuming its normal aspect again after the birth of the embryo." I was not, however, able to obtain any evidence of such change; the characteristic granular appearance remained throughout. Many embryos were seen to escape; as indicated in the figure 4, which represents an optical section, the extrusion takes place at the anterior surface surrounded by the four anterior marginal lobes. The partition is

preceded by a back and forth motion of the parent which reminds one of the alternate shrugging of the shoulders, at length this motion becomes more violent when the ciliated young is suddenly excluded and swims away with a velocity that defies one to follow it.

OUR EIGHTH ANNUAL MEETING.

E. H. GRIFFITH.

THE prospects for the eighth annual meeting of the American Society of Microscopists seem to be more promising now than ever before at so early a date. The acceptance of the cordial invitation for us to meet at Chautauqua is heartily indorsed, and this year many will take their wives and daughters with them, who in the past have gone alone; and when more of the wives and daughters become interested in our Society we may be sure that some of them, at least, will unite with us, and become most excellent members, as are those who are already of our number. It is also certain that when several members of the same families learn to love the microscope on account of its revelations, much more time will be devoted to its use, fewer evenings will be passed away from the home circle, and consequently, greater progress will be made. Business men of our Society, who have seldom, if ever, attended its meetings, promise to be present this year, for they can enjoy the convention, and at the same time escape the heat, the dust, the bustle, and the confusion of city life, and enjoy a few days on the shores of the beautiful and health giving waters of Lake Chautauqua, one of the most delightful summer resorts on the American continent. It seems to be the general impression that no more fitting place could have been selected, or one more calculated to secure a successful meeting.

Several years ago at the Detroit meeting, when Mr. Brearley of the Detroit Society, the writer, and some others advocated Chautauqua as the best place to assemble the next year, a cordial invitation from the authorities there was sent to us in answer to a letter from Mr. Brearley, but circumstances at that time interfered with its acceptance.

The working session, which all must admit has become one

of the most important features of our meetings, will probably be given an entire day, or an afternoon and evening. Thus far not a single member has refused to assist, and among the experts this year will be found a larger percentage than usual of our lady members. It is desired that all earnest working microscopists shall contribute towards the success of this session; and all competent workers are hereby cordially invited to do so, providing they will report to me at Fairport, N. Y., previous to June 1st, what assistance they are willing to render. Short descriptions of everything of interest to microscopists are solicited to be sent in now or at any time before the first of August. Descriptions of every new thing used, and of all new methods of work, also of old methods which have been thoroughly tried and found successful, are desired for the Working Session Department of the Proceedings. It is earnestly requested that these papers be sent at the earliest possible date. Questions and answers are also solicited, now matter how simple the questions may seem, providing information is really desired. Many an expert has been unable to answer some of the simplest questions, and it is safe to assert that few answers will be given in response to the one in the last number of THE MICROSCOPE in regard to the *length of a ten inch tube.* No one likes to admit that he is unable to determine the magnifying power of his objectives or their angles of aperture, still it is a fact, nevertheless, that not one in four who own microscopes can tell how it is to be done. Not long since a would-be expert informed some of his friends that he has a superior two inch immersion objective, while another spoke of the "mighty focus" of a certain microscope; and still another knew that the *Arachnoidiscus Japanicus* was made in Japan from its peculiar style. A student in an Eastern College showed more wisdom than either of these when she innocently asked, "what part of the microscope is the tube cast?" Only by asking questions with our eyes as with our tongues shall we gain knowledge, and a rediculous question may always be excusable while foolish assertions without knowledge often make the would-be wise man a laughing stock, much like a young man who recently chanced to be with a party who were looking at Jupiter through a small telescope. He would not condescend to look through so inferior a glass

that would show but "four moons belonging to Jupiter, while a friend of his owned one that would show *eleven*." Let us have plenty of questions and plenty of answers. The lady desiring to know about the "tube cast," was enlightened, while the other parties probably do not know, to this day, that they made f——s of themselves in trying to show their wisdom. Something in regard to the programme will be given soon.

SMALL PHOTO-MICROGRAPHIC CAMERA.

BY FREDERICK W. MERCER, M. D., F. R. M. S.

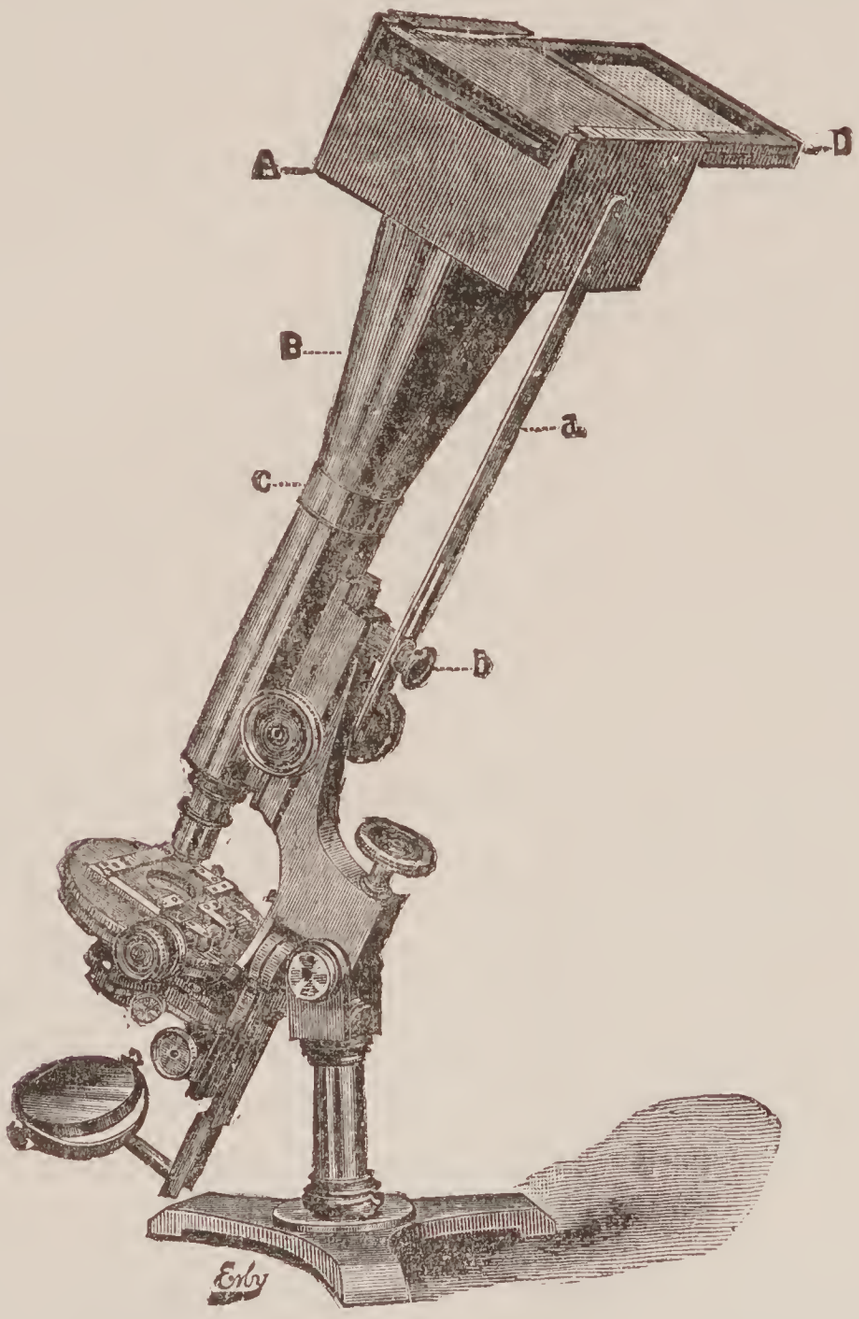
AN introductory argument in favor of photo-micrography is unnecessary, as the science has received such general recognition, that it only remains to point to changes and improvements in apparatus, and leave the rest to the observer.

The little instrument illustrated here, was described in the *Journal of the Royal Microscopical Society*, and is now introduced to the notice of your readers, because a description of it has not appeared in any American periodical devoted to microscopy. Since first described this camera has been quite thoroughly tested by a number of competent workers; their favorable judgment, and frequent inquiry from others as to its manipulation, has made it seem that some general answer in this way might be gratified.

The camera is made by several manufactures of photographic apparatus, in this country, chiefly by the Blair Co., and the Scoville Co. It is made to take plates $2\frac{3}{4} \times 3\frac{1}{4}$, or $3\frac{1}{4} \times 4\frac{1}{4}$. The former sized plate is the one most generally adopted, and should be of extra thin glass as supplied by Mr. Corbett, of Philadelphia. Lantern slide $3\frac{1}{4}x4\frac{1}{4}$ can be made directly from these.

The whole apparatus is exceedingly portable; measuring, with draw-tube inverted, $4\frac{1}{4} \times 4\frac{1}{4} \times 9$ inches. It can be attached to and used with the microscope in any position, but a few minutes time being necessary for its adjustment. It is intended for use with eye-piece or amplifier; it can, however, be used without either. The small negative made by this camera can be enlarged without perseptible deterioration.

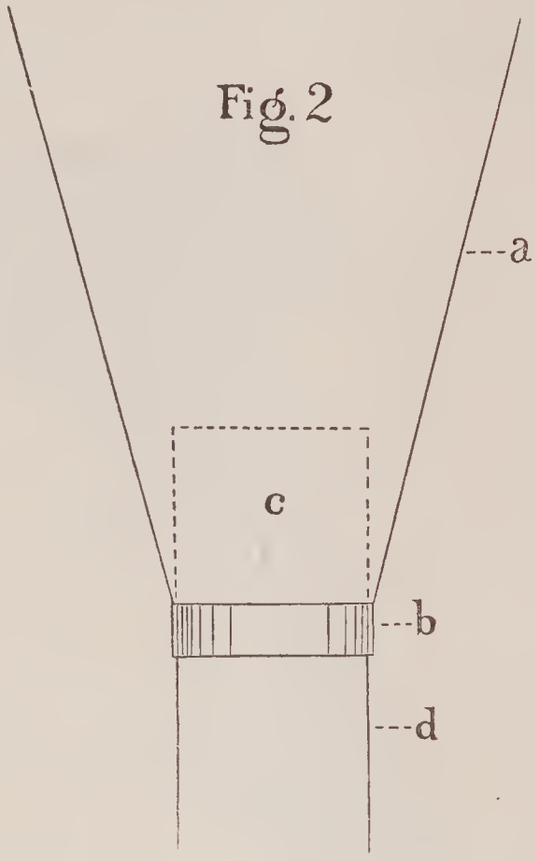
Since it can be used without special apparatus other than a cell for solution of sulphate of copper. The camera differs from all Continental or other models, in its lightness, its easy adjustment anywhere from the horizontal to the vertical, and the manner of supporting its weight upon an immovable part of the microscope instead of upon the body, so that it can not by its weight change the focus during manipulation. The first cost is small, and the working expense less than that of any other form. In order to insure satisfaction, the apparatus should be well made. There are some in the market having serious defects, such as imperfect joints whereby extraneous light is ad-



mitted. In the illustration, the instrument is shown ready for use: A, is the camera box wherein may be concealed a shutter; B, is the brass cone; C, is the collar through which

the draw-tube moves; D, is the plate-holder and ground glass in one frame; a, is the brass strap carrying weight of camera, and b, is the binding screw, fixed to immovable point upon the stand, its position, of course, varies with the model of microscope. The binding screw can be made and attached by any handy worker in metal. Fig. 2, shows section of fitting of cone and draw-tube; a, is the cone; b, is the collar through which the draw-tube slides; c, is end of draw-tube projecting into cone, for the reception of eye piece; d, is the end of draw, to be

Fig. 2



inserted into body of microscope. The tube d, should slide through the collar b, smoothly, and sufficiently tight to insure the exclusion of extraneous light. When in use the camera should be raised (so that the collar at b, does not rest upon the body of the microscope) and fixed in position by the binding screw, this permits a free movement of coarse and fine adjustment during focusing. In all positions, excepting the horizontal, light is reflected from the mirror, and is quite satisfactory.

SHOULD our subscribers have any numbers not necessary to complete their files, they will confer a favor upon somebody by sending them to this office. Calls for odd numbers are many more than we can supply.

METAL MICROMETERS.

M. D. EWELL, CHICAGO.

I DOUBT not that many of your readers are familiar with the use of micrometers ruled upon metal; but as some may not be familiar with their use, I venture to call their attention to the fact of their very great superiority over glass. To say nothing of their greater durability, in point of clearness and sharpness of outline there is no comparison whatever between the two. Any one who has ever seen the lines of "Cm. Scale A," or of the standards ruled by Prof. Rogers upon speculum metal, will have no doubt upon the question. With a high power the edges of the lines ruled upon glass appear rough and uneven; but I have never yet been able to find a power high enough to produce such an effect upon my speculum-metal centimeter ruled to $\frac{1}{100}$ mm., though I have examined it with a Zeiss $\frac{1}{18}$, Bausch & Lomb amplifier and $\frac{1}{2}$ in solid eye-piece, with the draw tube drawn out to its greatest length. In using this scale I usually use a splendid $\frac{1}{4}$ opaque illuminator made by Bausch & Lomb; with the high powers I use one of Prof. Smith's vertical illuminators, which gives excellent results. For use on metal plates, however, I have never seen anything quite equal to the opaque illuminators made by Messrs. Bausch & Lomb, which have absolutely nothing to be desired as to illumination, and which are much easier to manipulate than the ordinary vertical illuminator, though the management of the latter is not difficult, nothing further being necessary than to throw the light from a lamp through the diaphragm on the side of the illuminator by the use of a bull's-eye condenser and to use as small an aperture for the admission of light as possible.

ASTIGMATISM AND ITS RELATION TO THE USE OF OPTICAL INSTRUMENTS FURTHER CONSIDERED.

BY. E GUNDLACH, ROCHESTER, N. Y.

IN the February number of THE MICROSCOPE I find a somewhat extended criticism upon my article on "Astigmatism" which appeared in the preceding number of the same journal. I feel under obligations to my esteemed critic for the able manner in which he discusses this important subject, and am bound

to acknowledge my error in giving the causes of this defect of the eye. The valuable and interesting ideas thus brought out will render greatly increased benefits to the public, and while I am not only willing but glad to acknowledge Dr. Stockwell's superiority in his exposition of the causes of Astigmatism, I can not deprive myself of the opportunity of answering his objections to my proposed plan of using an asymmetic eye-piece—the less so that these objections appear to be well founded and, therefore, have undoubtedly the approbation of many readers.

The Doctor, after giving his various objections to my ideas, proposes to correct the difficulty by attaching to the front of the ordinary eye-piece, by means of some suitable contrivance, a separate lens of asymmetric form, which may easily be removed. He afterwards comes to the conclusion that a better plan would be to have suitable cylindrical lenses mounted in spectacle frames to be worn only when using the instruments. To this plan I object.

Spectacles should never be used with any optical instrument, however great or of whatever nature the optical defect or defects of the eye. Spectacles that may correct these troubles satisfactorily, under ordinary circumstances, are always injurious to the proper performance of optical instruments, and, therefore, the wearer of spectacles should always remove them before using the microscope or telescope. That spectacles are injurious to the performance of these instruments is attributed mainly to the following reasons: In the first place they prevent the eye reaching its proper place, or proximity, to the eye-piece, which is the plane of the crossing of the light pencils emerging from the eye lens. Secondly, the generally very excentric and oblique position of the spectacle glass to the optical axis of the eye and, consequently, also of the instrument, greatly injures the proper performance of the latter. The third objection is that spectacle glasses add two light refracting and reflecting surfaces to those already existing.

It is almost impossible for the observer wearing spectacles to even roughly place the optical axis of the spectacle lens, if worn in the ordinary manner, in line with that of the instrument. This could of course be accomplished by mounting the glass upon the eye-piece according to the first suggestion of Dr.

Stockwell, but even this arrangement would be much inferior to the device suggested in my article, as it requires an additional lens to the eye-piece which occupies a part of the valuable space between the eye-piece and the eye. While spectacle glasses properly have to be constructed to fulfil at the same time three separate conditions, viz.: 1st, the connection of the astigmatic *curvature;* 2d, the astigmatic *axis;* 3d, the abnormity of the focal length of the eye, my eye–piece requires only the cylindrical curvature of the front surface to accomplish the same result. In proposing to start by making three different eye lenses for selection, I did not mean to say that it is unnecessary to have the eye throughly examined for astigmatism by a specialist, and then construct the eye-piece in exact conformity with his formula, but, I expect in this simple way to approximate the exact curvature near enough to reach a very decided improvement of vision. Indeed for the correction of any kind of abnormity of the eye, three different lenses can be constructed with such proportionate curvature, in geometrical progression, that, in most cases, one of the lenses will correct, or, least, so greatly reduce the error that a person troubled with astigmatism may, from the effect, regard the correction to be almost perfect. And even in the most aggravated case, which is, when the defect requires a lens laying just midway (in geometrical progression) between two of the three lenses so that their correcting power would be equal; in this case the improvement would yet be very satisfactory, and, indeed, it would be very great. I claim that most wearers of spectacles who believe in having just the right "number" of glasses, are, in fact, more out of the way than they would be if they had, of the three different lenses, in accordance with my idea, the one nearest to fitting their eye, and I am not willing to except astigmatism from this statement.

NOTE FROM DR. TAYLOR.

I HAVE just received the *Ohio State Journal* of March 8th. It contains a report of the work of the experimental station, of Ohio, detailing the investigations of H. E. Weber relating to his oleomargarine and butterine experiments. So far as his experiments relate to butter and to the detection of butter in oleo-

margarine and butterine are concerned, he clearly endorses my published statements, but strange to say, he has not even made an attempt, by my methods, to discover lard or other fat crystals in oleomargarine and butterine as sold in the markets. As soon as I have an opportunity I will point out where he has wholly failed to comprehend my work. The chemists of the Ag. Dept. have now demonstrated the truth of my published statements on this subject. The important point which experimenters seem to lose sight of, is that the object is to detect the presence of foreign fats in butterine instead of the presence of butter, and that to find out whether *butter* is pure or not we must find whether *lard* or *other fat crystals are present in it.*

Yours truly,

THOMAS TAYLOR, M. D.,

Microscopist of the Dept. of Agriculture.

P. S. Had Prof. Weber read my full report instead of only the abstract, he would not have made the above mistake.

T. T.

NEW METHOD OF FIXING SECTIONS TO THE SLIDE.

H. E. SUMMERS, CORNELL UNIVERSITY.

THE following method has been tested with paraffin and celloidin sections. For either kind of sections the slides are first coated with collodion, either by flowing from a bottle or by a brush, and allowed to dry. The celloidin used for embedding, thinned with alcohol and ether, answers admirably. The coated slides may be kept indefinitely before using.

Paraffin sections are arranged upon the slide and a small amount of a mixture of equal parts of alcohol and ether is then dropped upon the slide. The liquid will be immediately drawn under the sections. Bubbles of air will rarely remain beneath the sections, but if they do, they may easily be displaced by gently touching the section with a soft brush. The liquid is allowed to evaporate spontaneously. When quite dry, which will take but a few minutes, the paraffin may be dissolved and the sections will be found firmly fixed.

Celloidin sections are placed for a few minutes in 95% alcohol, and then arranged on the coated slide. They are drained as free of alcohol as possible, and as soon as their surface is

nearly dry, as is shown by its assuming a dull appearance, the mixture of alcohol and ether is dropped upon them rather freely. When this has evaporated until the surface of the sections again assumes a dull appearance, the slide is placed in 80% or weaker alcohol, and may then be treated by any of the reagents applicable to paraffin sections fixed with collodion.

The advantages claimed for this method are three: the use of heat is dispensed with, and thus one source of inconvenience and injury to the sections is avoided; the paraffin is not removed (or melted) until the sections are fixed, and thus in sections consisting of disconnected parts, the position of these parts is preserved; labor and work-table space are saved by having a single method which is applicable to both paraffin and celloidin sections.

EDITORIAL NOTES.

PROCEEDINGS OF THE EIGHTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MICROSCOPISTS.—We are in receipt of the above from the Secretary, Prof. D. S. Kellicott. At a glance it is seen that the general style of this volume is much in advance of most of its predecessors. The quality of the paper, the illustrations, and the proof-reading are very satisfactory. In previous numbers we have noticed as many as four errors in proof reading on a page, with a whole form missing or duplicated. We do not discover any such evidences of hasty work in the volume before us. In fact the whole volume reflects great credit on the publishing committee. What credit does it reflect on our society? "Science," elevated, as it thinks it is, on its high-toned pinnacle at Boston, will doubtless have something to say about this "volume of the proceedings of a company of amateurs and novices." The fact is no reader of "Science" ever saw in that journal an article that commenced to show the amount of skilled, scientific labor that the paper by Prof. W. A. Rogers shows, on page 154. We also call the attention of "Science" to the address of our President; to the articles by Pres. J. D. Cox, and to others we might mention as well. We turn with some interest to the article by Dr. Thos. Taylor on "Butter and Fats." An abstract of this paper has already appeared in this journal, see Sept. No. 1885, p. 212. The question is, can butter

be told from oleomargarine by microscopical tests? It will be remembered Dr. Taylor claimed this could be done in a very positive manner. At the Cleveland meeting, and at the request of Dr. Taylor a committee of five was appointed to review the work and make a report to the society confirming or not these statements. We have anxiously awaited the report of this committee, for the subject is a most important one, and is so considered even by the Government authorities at Washington. We look in vain for this report. The committee have had ample time to report, and they owed it to the society so to do. We hoped to hear from them even if they could report nothing but "progress." Especially desirable would this report be at this time, when Prof. Weber, of the State University at Columbus, Ohio, has made public the statement that Dr. Taylor's discovery is useless; for by simply mixing a little water and salt with the oleomargarine it will give crystals identical with those of butter. The same results are obtained by treating tallow in the same way. We understand Dr. Taylor says Prof. Weber has *not* overthrown his discovery. We have written Dr. Taylor on the subject and we hope for an early reply. We imagine the papers of Dr. Holbrook would not have been passed without some sharp criticisms had the author been present, and his paper read in any other way but "by title." There is a slight error on page 240, with respect to our belief in the third corpuscular element. We *do* believe in the presence of a blood corpuscle aside from the recognized red and white. We *do* believe in the "blood-plates" of Bizzozero, and others. We do *not* believe in the so-called colorless corpuscles of Norris. As Hayem says, they are the result of the reagents used. For proof of this see our Histology, 3d edition, p. 84. The society now numbers over 300 members; and is in good flourishing condition financially as well. The outlook for another successful meeting at Chautauqua this summer grows brighter and brighter.

THE latest bacillus-craze comes from Spain. A Dr. Don G. Puerta has discovered in common tincture of opium certain bacilli that look exactly like the comma-bacilli of Koch. They are very active and are found in abundance on the sides and bottom of the vessel containing the tincture. We cannot read the account without wondering if Dr. Gregg, of Buffalo, has

gone to Spain, and that his name in Spanish is Puerta. Puerile it should be. Perhaps, however, these bacilli are the active agents in producing the effects of this powerful drug. Who knows?

AMONG the articles in our possession for publication are "Measurements of Blood Corpuscles," giving results of over 10600 measurements of corpuscles of different animals; "The Laughable in Science," an exceedingly interesting account of the humorous things found in science; "Results of Microscopical Research," containing recent discoveries in this department of work. We give more "Original Matter" in this journal than is found in any other microscopical journal in the world.

A NUMBER of new "Exchanges." Notify us when your notice has served its purpose, and thus make room for others. We cannot devote over one page to this purpose. Some have sent us notices with no signatures. Be brief and concise.

DR. A. Y. MOORE is the first again; this time to *stain* Am. pellucida. We shall soon expect to see a slide of this diatom, prepared by him, with the lines one color and the interspaces another.

IS THIS PARAGRAPH MARKED? Then consider it a polite invitation to send us one dollar for 1886. One dollar is not so very large to you; in the aggregate it is everything to us. Please aid us by promptly responding to this call.

REVIEWS.

RECHERCHES ANATOMIQUES SUR LES ORGANES VEGETATIFS DE L URTICA DIOICA L. Par A. Gravis. 4 to. pp. P. 256. 23 plates. Bruxelles. 1885.

This is a most elaborate work, and the plates, as is usually the case in European monographs, are of the best. The author states that he has made 15,000 sections of *Urtica dioica* alone; and he not only studied this plant but all its relations as well. He has made a complete study of the stem, the leaf, and the root from the first appearance of these organs to their completest development, no region being neglected. The author is of the opinion that anatomical and embryological characters will

furnish the same basis of classification among plants as it has already done among animals.

SOME NEW AND RARE DIATOMS. By W. C. Walker, Utica, N. Y., and H. H. Chase, Geneva, N. Y. 1886.

This is Part I of a series of papers that will be issued four or five times a year. There are eight pages of the text and two photographic plates. We highly commend this enterprise and sincerely hope it will receive the support it deserves. But there shold be a great improvement in future numbers in the original drawings of these new and rare forms, a more careful and accurate use of the pen. The edition is limited and can be obtained, by early application to either author, for one dollar a part.

THE ROTIFERA; OR WHEEL ANIMALCULES. By C. T. Hudson, and P. H. Gosse. 1886. London. W. P. Collins, 157 Gt. Porland St., London, England, general agent.

The book, now being issued in parts, will be illustrated with original drawings from life. There are to be six parts, and each part will contain five folio plates of colored drawings. Mr Collins will send a prospectus to all interested parties.

EIN PTOMAIN AUS GIFTIGEM KÄSE. By Prof. V. C. Vaughan, University of Michigan. 1886.

The above is a reprint, from "Zeitschrift für Physiologische Chemie," of the work done by our colleague, Dr. Vaughan. We knew very well that this work was recognized in our own country as entirely original with Prof. Vaughan, and it is certainly pleasant, to say the least, to find that Hoppe-Seyler, of Strassburg, thinks equally well of the work there.

THE CENTURY.

We said in our February number that this journal always contained "instructive and entertaining reading" and so it continues to do only in an increasing manner. The "Memoranda of the Civil War" are especially interesting in the March number.

THE PUBLISHED WRITINGS OF ISAAC LEA, LL. D. With portrait etching, pp. 280. By N. P. Scudder. 1885, Government Printing House.

THE MICROSCOPE IN MEDICAL DIAGNOSIS, pp. 11. By H. D. Walker, M. D., Franklinville, N. Y.

ITEMS.

ILLUMINATION BY AID OF AIR-BUBBLES.—"For very delicate structures, such as fur-fibres," continues Mr. Brevoort, "I often purposely permit air-bubbles in the mounting material, or introduce them into it. The chances are that some of the fibres will pass through some of the air-bubbles, and when they do this in the proper position, the fibres will be found to be illuminated by the reflection of light from the upper part of the concave surface of the bubble, and the surface of the fibres may be studied with a $\frac{1}{16}$th-inch immersion lens as readily as with a 1-inch. This method of illuminating I find of great service with the highest powers. I have used it with balsam and glycerine. With the latter it works exceedingly well. The air-bubbles may best be introduced by means of a stylographic pen-filler.—*Journal N. Y. Mic. Society.*

MICROSCOPE, MICROSCOPIC, MICROSCOPICAL.—The practice of even the most scholarly microscopists is not quite uniform in the employment of the words microscope (used adjectively), microscopic and microscopical. Is it not desirable to make an effort to bring about uniformity? The usage which best commends itself to us is in accord with the following directions:—1. Apply "microscope" (the adjective) to the component or essential parts of the microscope. *E. g.:* microscope stand, microscope stage, microscope objective. 2. Restrict "microscopic" to objects or features too minute to be seen or appreciated by the naked eye. 3. Reserve "microscopical" for uses to which the term "microscopic," as above restricted, would be inappropriate. *E.g.:* Microscopical Society; microscopical accessories; microscopical science' works, observations, researches, themes, purposes, uses; microscopical examination. As an epithet to the word "examination," microscopical is certainly preferable to microscopic, since the idea intended to be conveyed is of an action performed with the aid of the microscope, rather than of one too minute to be visible to the naked eye. Among professional men an organized society of microscopists is now generally, if not universally, denominated a Microscopical Society. "Microscopic Society" is sometimes heard, and, unfortunately, it sometimes gets into print. Its use ought to be actively discountenanced.—*Journal N. Y. Mic. Society.*

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

FOR EXCHANGE—One Fiddian Microscopic Illuminator, one Brass injecting Syringe with four pipes and stop cock, one Microtome (Brass) Rivet, improved, with knife, one Dr. Seilers Section Knife and Carrier, one warm Stage with Thermometer and Gas Chamber in exchange for first class Polariscope with goniometer Eyepiece or collection of thin mounted Rock sections.
DR. HENRY FROEHLING, 17 South 12th street, Richmond, Va.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

HISTOLOGICAL and Pathological Slides to exchange for other good slides.
F. F. COLWELL, Urbana, Ohio.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W. WESTOVER, M. D., St. Joseph, Mo.

FOR SALE.—Am. Month. Mic. Jour. 1882-3-4 and 5 unbound; also Journal Post. Mic. Soc. of England, Vol. I. and II. What offers? GEORGE TIMMINS, Syracuse, N. Y.

FOR SALE.—Zentmayer's 1-10 Objective, practically new. Also Moller's Diatom Plate No. 2.
E. K. BAXTER, Sharon, Vt.

WANTED.—A copy of No. 1. Vol. IV., The Microscope; will give slides in exchange, or cash.
Very Truly, HENRY FROEHLING, Richmond, Va.

WANTED.—Unmounted material, any kind; foram-inifera and diatoms preferred; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

WANTED.—Good 1-4; spy glass; will exchange good objectives, including new Gundlach 4-10 of 80°. C. OUDERDONK, Rugby, Tenn.

WANTED.—Books on Microscopy. Will give slides or cash for same.
HAROLD PLOWE, Peoria, Ill

WANTED.—Micrographic Dic'y, 4th ed. Will give Wales 1-10 immersion, 135°.
DR. ED. GRAY, Benecia, Cal.

FOR EXCHANGE OR SALE.—Ether freezing microtome, pocket microscope lamp, 2 in objective by Tolles. A. B. AUBERT, Orono, Maine.

THE MICROSCOPE.

VOL. VI. ANN ARBOR, APRIL, 1886. No. 4.

ORIGINAL COMMUNICATIONS.

THE LAUGHABLE IN SCIENCE.

SCIENCE is not all sober; it has its funny side; and scientific men enjoy a laugh as well as the members of any other profession. There are constantly many "good things" turning up over which the student has his smile, or, it may be a hearty roar of laughter. Would it not be well to have some place where all these items could be gathered together? If not a book of humorous items, a department in some scientific magazine which should correspond to the well-known "Drawer" of Harper's Magazine?

These humorous or funny items of science may be classed in three categories (classification, be it remembered, is a characteristic of the scientific mind and we *must* classify everything we study). The first group embraces all those examples where the inborn wit of the student cannot be controlled; the subject is a good one and the impulse is irresistible. The joke must come, no matter if it comes in the pages of the most profound disquisition. Examples of this sort are comparatively common, and we need only cite the remarks which Dr. Gray makes in his "Field, Forest, and Garden Botany" concerning the species of Lunaria: "Common honesty, not natural to the country, but cultivated in old-fashioned places. Perennial honesty is a much rarer sort, and seldom met with here."

A different type is that where a scientific writer unconsciously places incongruous things together. Instances of this sort are not so common, but the writer recently met one in the pages of the "Proceedings of the Philadelphia Academy of Sciences." A learned palæontologist described a new species of trilobite; the *tail* of the specimen was all he possessed, but it

was described and named in honor of a fellow-palæontologist, and the specific name was "*broadheadii.*"

A third, and, unfortunately, too common class of scientific humour proceeds from the fact that people are given to dealing with that which is beyond them. They attempt that which they are not qualified to perform, and the result is lamentable and frequently laughable. Most of these mistakes excite only a feeling of contempt, but occasionally an example is found in which the blunders are so enormous that the true scholar loses all other feelings than that of the ridiculous. Although these instances are far from rare, it but seldom occurs that one can find so many wonderful mistakes combined in one volume as occur in a little work which has recently fallen into my hands. It is a duodecimo volume of three hundred and twenty-five pages and bears the pretentious title, "Dictionary of Scientific Terms, by P. Austin Nuttall, LL. D.," and was published in London about fifteen years ago. It seems not to be generally known in America, and a few of the wonderful statements and definitions it contains will doubtless be appreciated by all.

The work begins with a "preface" outlining the growth of science and scientific ideas and the corresponding increase in our vocabularies. A few instances are here given of the new words which have thus been called forth and from them we select "Strongylus" (a parasitical action of the respiratory organs of pigs and calves)." The need is thus shown of a work which will "render the language of science intelligible, not only to the student, but to the general reader."

It would appear that the "general reader" (or it may be the student) is supposed to have but a vague conception of the limits, bearings, and methods of the various sciences, for the preface is followed by an "Introduction to the Classification and Study of the Sciences," which, when we remember that the work is dated "1869," is seen to embrace, space for space, a larger number of enormous blunders than any other article in the English language. "Naturalists class animal life by commencing from the highly-organized animals (such as those which walk, fly, and have nerves) to such as have very little structure." This extremely lucid statement is exemplified in many instances. Birds "are furnished for the most part with wings,"

"Edentates are animals wanting some of the teeth of other animals," while "Mr. Samuelson, a naturalist, took a glass of water and in a few days found its interior lined with slime, which proved to be a mass of monads all trembling with life."

There is a constant confusion of the name of a science with the names of groups of animals, thus "Entomology has been subdivided into eleven orders," and the definitions of these orders are rich. Who can extract a single idea from the following? Siphoniptera "have mouths with a sucker of two pieces," Hemiptera have "two wings covered, and an elytra, as in the grasshopper," while the Lepidoptera have the wings "covered with farina," and the Diptera alone are accorded six feet.

In Botany the case is much the same; "the principal writers on this interesting science are Linnæus and Jussieu," although the classification of Professor Lindley "appears in some measure to be supplanting the recognized systems of" the two anthors first named. In Mineralogy Werner and Mohs are the only authorities mentioned, while in Geology only the first of these is quoted and his classification is adopted. On the same page occurs the expression "life, which is spirit."

It would be unfair were we to quote the above alone, for frequently it occurs that a person who is ignorant of one subject may be posted on another, and the man who attempts a scientific dictionary should know something of at least one science. Let us test our author on the physical sciences. One test will be enough. The text shows that he has a conception of the elementary nature of metals, and then follows the following wonderful list: "A few of the principal metals are here given in alphabetical order: Antimony, Arsenic, Bismuth, Blacklead, Brass, Cobalt, Copper, Gold, Iridium, Iron, Magnet, Manganese, Mercury, Nickel, Ochre, Pewter, Platinum, Silver, Steel, Tin, Tungsten, and Zinc,"—a list of twenty-three names and only seventeen of them metals!

The dictionary proper is arranged in alphabetical order and is largely made up of medical terms, these forming at least a third of the whole work. Among these especial prominence is given to those in use a century ago. Among the other words "definitions which do not define" are the rule, and on every page one or more egregious mistakes occur. Throughout the

whole work there is a confusion between the different groups of animals and plants; examples are taken from one group to illustrate the definition of another; the meanings of the words genera and species are confounded; the principles of physics and chemistry are utterly ignored; in short, the work is a "complete encyclopædia" of misinformation. In the following extracts portions have been omitted, but there is no garbling, no perversion. The derivations have been omitted and in most cases the italics are ours. One case of derivation, however, needs mention: "Metrorrhagia (Gr. *meter*, and *segnymi*, to burst forth)."

First come a few definitions for the mathematicians and astronomers.

"Galactic circle, in astronomy, the circle at right angles to the diameter, forming the galactic pole. The galactic poles are the opposite points of the celestial sphere, round which the stars are most scattered."

"Sliding rule is a mathematical instrument serving to solve a number of questions from the change of the slider by inspection."

"Octahedral, having eight *equal* sides."

"Y-level, in surveying, an instrument for measuring altitude and *distance*."

The chemist may learn some new facts and methods as well as of some bits of useful apparatus from the following:

"Amber . . . Its component parts are carbon, hydrogen, oxygen, and ashes."

"Air-lamp, a pneumatic machine, formed by the combination of inflammable air and electricity, which, by turning a stopcock, produces a flame that may be restrained or continued at pleasure."

"Aurigraphy, the art of writing, in which diluted gold, instead of the common ink, is nsed."

"Elaidic acid, an acid, the result of the action of nitrate of mercury."

"Ic, in chemistry a termination affixed to those acids which contain in combination the highest known quantity of the acidifying principle."

"Physeter, a filtering machine, consisting of a tub with an air-tight perforated stage."

"Promethean, a small glass tube containing concentrated sulphuric acid, surrounded with an inflammable mixture."

"Prussic, in chemistry, noting a very poisonous acid, called hydro cyanic, and forming the coloring matter of prussian blue."

"Tincture, the volatile part of a substance separated by a menstruum."

The biologists are especially favored in this collection, for not only are the descriptive terms they employ defined, but their genera and families are chaarcterized, but not always correctly. Thus the Ægerideæ are "lepidopterous insects; the hornets"; Alasmodon is a species of the genus Unio; the principal species of Argonauta "is the Argo; the nautilus"; Buccinum is made a genus of bivalved mollusca; the "Colubridæ, a numerous family of poisonous serpents"; and the "scorpion an insect or small reptile having in its tail a venomous sting"; while Brachionus is "a *genus* of rotiferous Infusoria of which there are several *genera*."

"Alitrunk (Lat. *ala*, a wing, and *trunk*), in entomology the *hinder* segment of the body of an insect, with which the *legs* are connected."

"Draco . . . In entomology, the name of an insect found in India and Africa, and distinguished from the Lizard tribe merely by having a broad lateral membrane, strengthened by radii or bony processes. It lives among trees, and is able, by means of the membrane, to spring from tree to tree." The question at once arises, can this Draco be the same as the Echidna, which is defined as "a genus of spring quadruped"?

"Cirripeds, a class of Mollusca, the animals of which are furnished with a mantle and testaceous juices."

"Mesentery, in anatomy, a membrane by which the intestines are attached to the vertebræ."

"Alcyoneæ, a group of polypiferous Acrita, more nearly allied to animal life than the sponges; the Alcyonium, a genus of sponges, is the type—Alcyonella is a fresh-water specimen."

"Ovary, in anatomy, an organ containing the *female* ova, or in which they are impregnated."

The following definitions form a fitting conclusion to these few extracts. Word for word the writer doubts if their equal

exists. What ideas our lexicographer had when framing them is even beyond the imagination.

"Mountain soap, in mineralogy, a variety of *green* earth of a *brownish* or *blackish* color."

"Thallite, in mineralogy, a substance variously denominated by different authors."

"Plumbane, a chloride of lead. It is the substance of which writing and other pencils are made. The finest kinds of it are found at Borrowdale, in Cumberland, from which a specimen was found to contain carbon, silica, alumina, oxide of iron and manganese, and water."

"Piano monitor is a bar of metal placed above and a little before the keys of a pianoforte, for enabling the young practitioner to rest on." N.

REPLY TO PROF. WEBER.

BY DR. THOS. TAYLOR, WASHINGTON, D. C.

IN answer to yours of the 6th inst., in reply to Prof. Weber's discovery of a cross on globules of fat, produced by triturating lard and beef oil, with salt and water; I have to say, that his process breaks up the fatty liquids into microscopic globules each one having a film of water. This agrees with a statement made by me which appears in my paper on "Butter and Fats," in the published proceedings of the American Microscopical Society of last year, which you have, see page 132, viz: That a body which is *globose*, *translucent*, *smooth*, and *polarizing*, will exhibit the St. Andrew's cross under polarized light. Starch, when moist and translucent shows the cross.

When the fatty solution, as prepared by Prof. Weber, is deprived of its moisture, the cross is no longer seen, the globules having become again a homogeneous mass.

The crystal of butter differs in this that when viewed by transmitted light it is seen to be a crystallized fat.

Prof. Weber's globules have no crystallization. The process the fats undergo by his method, does not destroy the stellated crystal of lard, and therefore the microscope will always demonstrate their true origin.

When I examine oleomargarine for the purpose of assist-

ing criminal prosecution, I determine the character of the substance from the crystals found. Should they be lard, no further investigation is necessary.

Crystals of butter are never seen until the substance is boiled.

Prof. Weber's experiments have no relation to my investigations, neither will they effect criminal proceedings against offenders of the butter-laws of the District of Columbia.

ASTIGMATISM AND THE MICROSCOPE.

W. J. MARTIN, DAVIDSON COLLEGE, N. C.

I HAVE read with some interest the articles of Mr. Gundlach on "Astigmatism and Its Relation to the Use of Optical Instruments," and Dr. Stockwell's criticism of Mr. Gundlach's proposed remedy.

Dr. Stockwell suggests the use of suitable spectacles by astigmatic observers, instead of specially corrected eye-pieces as proposed by Mr. Gundlach; and the latter gives several reasons for the statement that "spectacles should never be used with any optical instrument, however great or of whatever nature the optical defect of the eye." I have nothing to contribute to this discussion except my own experience; but as this is exactly in point I send it to you. My eyes are astigmatic, and I use sphero-cylindrical glasses to correct the defect. Formerly I was in the habit of laying aside the spectacles when I used the microscope; but latterly, to avoid the inconvenience of putting them on and off, I grew into the habit of using them while observing. And I fancied that I gained somewhat in clearness of definition. I had never set about testing this impression till I read Mr. Gundlach's statement in the March number. I then made a number of experiments such as this: with a combination of eye-piece and objective which would just fairly show me the lines on a given shell of P. angulatum when I used the spectacles, I could not see the lines at all without the spectacles. This was true both by daylight, good and poor, and by lamplight. And in every case where test objects could be seen both with and without the spectacles, the definition was better when they were used. The advantage in my case is not very great, but it is unmistakable. Whether a

specially corrected eye-piece would give a still greater advantage, I could not say without trying it. I am disposed to believe that it would, and possibly advantage enough to justify the expense and inconvenience of its use.

THE DETECTION OF RENAL TUBE CASTS.

A. Y. MOORE.

I have seen so many amusing mistakes made by physicians while making microscopical examinations for tube casts, that I should like to call attention to some sources of error, which, while being of small importance to some persons are matters of almost life and death to others.

Some time ago I was present when a physician was examining several bottles of urine for tube casts. He seemed to think it very strange that all of the bottles contained large granular casts. After some time, an idea seemed to strike him and he said: "Here, Moore, what's that?" I looked to see, and found a rather deep scratch in the slide which was very much like a large granular cast in appearance. It was this scratch, upon which was based the diasnosis of "Bright's Disease" in each case.

Is it any wonder that *such* a case of "Bright's Disease" should be cured by a change—not of climate—but of *slide!*

About a year ago I met a physician who had one of my slides of tube casts. After talking for some time about the value of the microscope as a means of diagnosis, he said "Do you know, I can't find a cast on that slide!" That impressed me as being rather strange; so I looked over the slide with his 1-6 in. objective. I found a large number of casts and showed them to him. "Well! Are *those* tube casts! I thought they were columnar epithelium." Yet he was one of the "leading physicians!"

Such cases are coming to light nearly every day; and, is it to be wondered at, that some persons consider the microscope as "all bosh" (whatever that may mean) and condemn it as a "plaything not worth thinking about!"

On the other hand may be found an equal blunder. A patient will take a bottle of his urine to his "family physician" and request him to examine it with his new instrument (which

may have French triplets) and see whether that pain in his back is really "Bright's disease," as he fears, or only "back ache." The physician will then, with extreme gravity, put a drop of urine upon a slide and perhaps look at it for a *whole* minute. When he finds a cotton fiber (which he supposes to be a tube cast) he will immediately show the extreme value of a medical education by knocking "horse-sense" in the head with: "Why, my dear sir, I am sorry to have to tell you so, but you really have Bright's disease, for I have found tube casts in your urine." The patient will then receive "treatment" and, strange as it may seem, may live for years; and the physician, without any undue conceit, will actually believe the longevity of the patient an evidence of his skill:—more than that—he may read a paper before the County Medical Society upon "The Curability of Bright's Disease" and bring up the patient as the horrible example.

Now, with such cases as these staring us in the face, I think I may be pardoned for bringing to notice a few simple points, which may put the initial microscopist upon his guard; and enable him to avoid some of these peculiar—but perhaps not unnatural mistakes.

All urine intended for microscopical examination should be taken, if possible, from that which is first passed in the morning. It should be placed in a conical vessel so that the sediment may be collected in as small a space as possible. After standing for five to ten hours, a small quantity of the deposit may be drawn up with a dipping tube.

Now, the question of the temporary mount is a matter o no small importance. Many persons recommend the ordinary live-box or animalcule cage for this purpose; but in about nine out of ten cases a person will find the brass flange above the cover a downright nuisance and in many cases the means of injuring a high power objective. Concave slides are frequently spoken of in "the books" as being convenient, but there is perhaps nothing which will give better results than an ordinary plane slide, so fixed that the cover-glass may not come in absolute contact with it—that is, the cover should be supported in such a way as to give considerable thickness to the drop of urine. This may be done in various ways. Two narrow strips

of thin glass may be cemented to the slide, or short pieces of hair or narrow pieces of paper may be placed under the cover. This will prevent the extrusion of the liquid to such an extent as only to permit of the examination of a film so thin as to contain no morphological elements; which of course may be a "reason why tube casts are not seen when really existing."

Now, the magnifying power to be used for the examination is or should be a matter of some consideration. "The books" will frequently recommend that from three hundred to five hundred diameters be used, and as a rule, the "family physician's" highest authority will be "the books."

Just now, I will not contradict "the books," but will advise the initial microscopist, of a medical turn of mind, to try various plans; it being well known that after awhile an idiocratic condition will be developed which may be said to be immutable in each particular case. It may be well, however, to begin with a good one inch objective. Now, a "good one inch objective" does not necessarily mean a lens of extremely wide aperture (and perhaps poor definition), but a lens *well corrected*; and it is highly probable that no American maker will supply any such lens of less aperture than will easily show what (in this case) may be required of it.

Now, if the slide be placed upon the stage and examined in the usual way, the probabilities are that nothing will be seen; but if dark ground illumination be brought into use, the presence of tube casts will be indicated (in all probability) by a faint, indistinct line of light (almost a "bluish shimmer"), showing, in the field, the position of each cast. These appearances cannot always be trusted, as indicating casts, until the observer becomes used to them, for other substances may give very nearly the same conditions (as to color, etc.) and yet *not* be casts. However, at such a (doubtful) stage of the examination it is well to use *central* light with a high power. This extra power may be obtained by a $\frac{1}{2}$ or $\frac{1}{4}$ dry objective of 100° air aperture; and this aperture will be found to warrant (so far as tube casts are concerned) a power of nearly a thousand diameters, if proper eye-pieces be used, and (as a matter of course) due regard is put upon conditions of illumination.

In many cases, however, it may be necessary, from a desire

to know more about any particular tube cast, to use a higher power,— that is to say, a higher capacity, as indicated by the (corrections and) numeric aperture of the objective. In such cases, it may be well to use a (so-called) homogeneous immersion objective having an "extra limital aperture." (That sounds big, but only means an aperture of "more than 82° in balsam.") It is obvious that the use of an immersion objective with a loose cover-glass will soon cause trouble, therefore when such an examination is to be be made, the cover may be held in place by using three small pieces of wax, instead of the hair or paper, and pressing the cover down upon these, until the desired distance between the slide and the cover has been attained. The urine may then be run under the cover by placing a drop at the edge. In such cases it is well to use very large covers to reduce the danger of moving the slide so far that the immersion medium may run over. I have frequently used covers 2 x 2½ inches; the slide being 2½ x 6 inches. Very few stages are fitted to take a slide of this size, however.

And right here, let me condemn such mechanical stages as have the milled heads above the stage. They are all well enough for amateur work—looking at mounted slides—but the *room* is not there, and the usual form of stage is to be preferred, even though the projection of the milled heads may be such as to prevent the complete rotation of the stage (and this is a very nice point—to talk about).

Ordinarily, however, a much smaller slide will answer and do good work. It is well to make a practice of using very thin covers, instead of thick ones, as some particular structure may be seen in the field which it is necessary to examine with a very high power. In such cases the thicker covers would prevent the use of objectives with very short working distance.

The indications of the various kinds of casts are perhaps too well known to need description.

TURN-TABLE IMPROVEMENT.

E. H. GRIFFITH.

TURN a disk of zinc white cement on the center of the turn-table and when hard, ring with pen and ink. For centering purposes the white center is of great value. The cement can easily be removed with benzole at any time if desired.

SLIDE LABELS.

E. H. GRIFFITH.

VERY beautiful and very practical labels for microscope slides may be quickly made with the brush and pen. On the ends of the slides turn smooth disks of good clear zinc white cement, and with finishing colors border to suit the fancy. With a pen write or print on the white center whatever is desired.

PROFESSIONAL MICROSCOPY.—So long as mind is associated with matter, uses its energies, or is obstructed by its limitations, will the knowledge of the laws of physical life interest man greatly and aid him to his goal. Indeed, biological investigation is, if we mistake not, the most absorbing of present purely scientific pursuits. The nature of the force called life may continue an enigma: its law of work, however, may yet become fully known, and this fulness of knowledge may better incalculably man's estate. But biology owes its existence to the microscope, and to that instrument must it look for its progress and its triumphs. And what, in its present state, is this instrument, with its immediate accessories, and all its various kinds of subsidary apparatus? and what the scope and quality of intelligence, of knowledge, of training of eye and hand, embraced in its mastery? To this question, the story, however simply told, of the work performed by Dr. Koch in his studies of bacterial life or by Drs. Dallinger and Drysdale in their researches on the origin and life-histories of the "least and lowest of living things" would be a grand sufficient reply. There is, then, a science of microscopy. Its mastery is peculiarly difficult, requiring rare sagacity and dexterity, and a lifetime of devotion, and its study has become a profession. This fact is not known to all, it having grown too fast for any but a watchful eye to keep pace with it. "There is no science of microscopy—the microscope is only an instrument," was said in our hearing a few days ago. A gun is but an instrument; yet is there not a science of gunnery? and its acquisition is an indispensable part of the professional soldier's education. The importance of a special and systematic course of instruction in microscopy is gaining recognition in some of our best institutions of learning. —*Journal N. Y. Mic. Society.*

EDITORIAL NOTES.

Report of Committee on Dr. Taylor's Discovery.—From the number of letters that have reached us bearing on this subject since our reference to it in our last issue, it is evident that a very large number are interested in this report, and, at the same time, are greatly disappointed to learn that the committee failed to do their work. It is certainly annoying that a whole committee should be charged with inactivity when some of its members, to our personal knowledge, have done such faithful, hard work. Mr. C. M. Vorce, of Cleveland, wrote us such a clear statement of the whole affair in a private letter, that we immediately wrote to obtain permission to use the facts he gave for the public good. Having obtained such permission we are prepared to tell just what was done and just where the report was last seen. Mr. Vorce assures us that the work was faithfully done by Mr. Atwood, Dr. Fell and himself. They sent frequent reports of progress to all other members of the committee, but none were received either by himself or Dr. Fell from the two western members. A Report was finally prepared by Mr. Atwood, signed by Dr. Fell, and forwarded to him. He attached his signature and sent the matter forward to Dr. Curtis, of Chicago, since which time not a word has been heard from it. Dr. Detmers says that he has never received any Report from Dr. Curtis. The proceedings were held back some time for this Report, until it was thought best not to hope any longer. It is proper to state that in a private letter Dr. Detmers says his own work fully sustains Dr. Taylor's claims.

Dr. Taylor vs. Prof. Weber.—We are in receipt of a somewhat extended Bulletin from the Ohio Agricultural Experiment Station, on "Testing Butter;" the same being a reply to Dr. Taylor, on his methods of examining butter and fats. After giving his theory of the formation of Dr. Taylor's "butter crystals" he says that there is no practical value whatever to the tests. All that is necessary to produce these "crystals" is the presence of a small amount of salt, or "a speck of any other solid matter in any fat." Dr. Taylor has a reply to this in the present number. Mr. Vorce says that Prof. Weber is certainly off the track somewhere, for he has followed Prof. Weber's ex-

periments carefully and cannot get a single "Butter Crystal" from tallow, lard or oleomargarine or any mixture of them, by any means he can devise. He says he has "carefully followed all the details given and can only get a pure tallow crystal," and that other observers report likewise. From the evidence already before us it would seem that observers unanimously agree that Dr. Taylor's methods are accurate and reliable; that it is possible to tell, by aid of the microscope, the difference between butter and other fats; that only one observer disputes it; and that his methods completely fail in the hands of other observers.

THE THERAPEUTICS OF BACTERIA.—It would seem, at last, that some practical value is to come from our knowledge of pathogenic bacteria. It is a well known fact that some species of bacteria exert a very destructive influence upon the culture of others. Accepting this, an Italian, Dr. Cantani, went to work to discover some pathogenic microbe that would exert such an unfavorable influence upon the bacillus of tubercle. The exceedingly common bacterium termo was found to have such an effect. Repeated experiments proved that inhalations of these microbes had no injurious effects whatever upon animals. Hence he proceeded to make a pure culture of the bacterium termo and diluted it largely with beef tea. This diluted culture the patient, affected with purulent sputum in which were numerous tubercle bacilli, was made to inhale by means of an atomizer. As a result, the tubercle bacilli rapidly diminished in the sputum, while the bacterium termo as rapidly increased. The fever declined, the patient increased in weight and general health. Of course, "one swallow does not make a spring," but should the researches of Cantani be verified, we have a positive and simple cure for tuberculosis. Koch has lately shown that the comma bacillus of cholera cannot exist in the presence of septic bacteria. What an immense field is opening here for the diligent student. Is it possible we are to have positive antidotes to these dreadful diseases? And if to these why not to many others? It is almost too good to believe.

PROF. KELLICOTT ACCEPTS.—A "College of Pharmacy" has just been formed in connection with the University of Buffalo, and Prof. D. S. Kellicott, has been elected to the chair of Botany.

We clip the following from an exchange; it meets our hearty endorsement: "Professor Kellicott, who has for many years filled the chair of Natural Science in the State Normal School at Buffalo, brings to the new college the prestige of a national reputation. To many of our readers he is personally known as an indefatigable student and thorough teacher; while to others he may be known by name only, for his original work in microscopic botany and zoology has given him an extended acquaintance among American scientists."

A SURPRISE PARTY.—Mr. Griffith is nothing more nor less than a whole surprise party. He surprises you by calling when you think he is a thousand miles away; by inventing some useful new accessory or valuable improvement on the old; and by never tiring in his labors for American Microscopy. This time a San Francisco paper says: "A stir of pleasant surprise was occasioned by the announcement that E. H. Griffith of Fairport, N. Y., was present as a visitor. Mr. Griffith is known far and wide to microscopists, not only as the inventor of the "Griffith Microscope," the "Griffith Turn-table," and numberless other ingenious devices, but also as pre-eminent in inciting and fostering the present wide-spread interest in microscopy. His reception by the members was very cordial and, by a unanimous vote, the use of the society's rooms was tendered him during his stay in this city. Mr. Griffith responded in a few well-chosen remarks, and, on behalf of the American Society of Microscopists (with which he is prominently identified), extended a warm invitation to the San Francisco society to attend the coming Microscopical Convention at Chatauqua, N. Y."

NEW OBJECTIVES.—It has been apparent for some years that no marked improvement could be made in objectives until some better materials were offered that the old crown and flint glass. One great trouble has been, at least so it appears to us, that the great majority of workers are content with glasses far from the best. In fact, a very earnest and competent worker stated in public that "student's" objectives were good enough for all histological work! Such being too commonly the belief, the manufacturers have not had sufficient demands made upon them for anything higher than their poorest or second best objectives. A prominent optician said recently that they studied how to

produce the very best objectives possible, largely from personal pride to excel rather than to fill any pressing wants of American investigators. It is certainly unaccountable when it is an indisputable fact that in order to have defining and resolving power we must have the best glasses; and that resolving power and angular aperture go hand in hand. The German government, realizing the above, appropriated some time ago twenty-five thousand marks to enable Dr. Carl Zeiss to make experiments in the manufacture of new glasses suitable for lenses. It is most gratifying to learn that Dr. Zeiss has succeeded beyond expectation. Dr. H. VanHeurck, of Antwerp, reports as follows on a new homogeneous immersion one-eighth, with a numerical aperture of 1.4: "It has greater resolving power than any we have had hitherto. Amphipleura argenteum is resolved into pearls over the whole surface, and with such sharpness that they may be counted. Bacteria will probably exhibit details of structure as yet unknown." Thus the report continues. We trust it will not be long before some of our readers will be able to announce himself the possessor of one of these new glasses.

This issue is nearly a week late. A quantity of proof lost through the mails, and not yet recovered, accounts for it.

FOR CEMENTING BRASS CELLS TO GLASS SLIDES.—1st. Carbonate of lead, ½ oz.; red oxide of lead, ½ oz.; litharge, 1½ oz. Grind thoroughly in a mortar. Stir some of this into enough gold size to make it work stiffly. If too much adheres to the work, turn it off on turntable when a little set. 2d. Best quality gum arabic, dissolve in cider vinegar; add a little sugar. A very strong cement, but have not tested it for durability.—*Mic. Bulletin.*

I REMARK, *en passant*, that the mere resolution of a specially high band seems to have been erroneously regarded by Herr Nobert and others as a sufficient test of the quality of an objective; whereas it can be demonstrated that the fact alone that an objective resolves a given band proves only that the particular zone of aperture which is utilized in such resolution is free from aberration; and this may obtain in an objective in which nearly the whole of the other portion of the aperture is so affected by aberration that the objective, as a whole, must be regarded as of inferior quality.—*J. Maydall, Jr.*

ITEMS.

STAINING.

BY V. A. LATHAM, LATE HON. SEC. U. J F. C., NORWICH.

RIBESIN AND EOSIN.—After expressing and throwing away the juice of black currants (*Ribes nigrum*), boil the skins for some hours in a 10 per cent. solution of alum. The resulting deep-violet solution may be conveniently diluted with water, and after a lapse of a day should be filtered, and may be used for staining. The stain resembles Boehmer's Logwood, but is a still more precise nuclear stain. It is a bright, somewhat greenish blue, agreeable, distinct, and permanent. Alcoholic objects stain quicker than chromic acid ones, but the most suitable are bichromate of potash objects. A ribesin stain may be followed by eosin. Brain and spinal cord give good results, especially when hardened in bichromate.

TO OBTAIN GOOD RESULTS WITH CARMINE.—After staining, the superfluous pigment is removed by washing in water acidulated with 1 per cent. hydrochloric or glacial acetic acid, or in rectified spirit 60 parts, water 39 parts, hydrochloric acid 1 part (Pritchard). The acid heightens the color. Tissues stained with carmine may be mounted in Farrant's solution, glycerine, or dammar.

PURPURIN.—Take about as much as will lie on the point of a pen-knife, boil in 50 cc. of glycerine, (it may either be concentrated or have a little water added to it), allow to stand for two or three days, and then filter. Unlike Ranvier's solution, it may be kept months without precipitation; it is quite permanent when mounted in Canada balsam and benzole, or glycerine slightly acidulated.

A SIMPLE AND SPEEDY METHOD OF STAINING ANIMAL AND VEGETABLE SECTIONS.—After cutting sections, wash them in water and allow them to soak for a while; transfer them to a solution of anilin violet 1 part, dissolved in 300 parts of acetic acid (commercial), leave them till sufficiently stained; which may be determined by removing the solution to clean water. Return if not stained enough. Mount after staining by transferring them to a clean glass slide, drawing off any excess of

fluid, and add a drop of a solution of acetate of potash of the following strength: Acetate of potash, 1 oz.; Water, ½ oz. Cover and fasten it with a ring of varnish, if it is desired to preserve it. The advantages are the simplicity and beauty of the results obtained; it is also good for exhibiting the structure of cartilage.

A GOOD STAIN FOR SPINAL CORD, ETC.—A solution of Hæmatoxylin prepared with water and alcohol. The sections are kept immersed in it during an hour, and the temperature is maintained between 40° and 50° C. = 104° to 122° Fahr. They are then removed from the solution, washed and placed for 3 hours in a 2 per cent. alkaline solution (Borax), or in one of potassium ferricyanide. Afterwards they are submitted to the influence of alcohol, xylol, and Canada balsam, in the usual manner.

CORROSIVE SUBLIMATE FOR BRAIN, ETC.—After the preparation has been hardened in Müller's fluid, instead of putting it in alcohol, place it for some days in a 5 per cent. solution of corrosive sublimate, which is renewed every day until the solution is no longer colored. If left *too long* the preparation becomes black, or if *not long enough* small black points appear. It is very elastic and firm, and very thin sections can be cut; it stains very well without ammonia, carmine, etc.

IRIDESCENCE OF FLY'S WINGS.—I do not think Mr. Tuffen West's explanation of extreme thinness more than half accounts for the iridescence of the wings of a fly. The color is certainly not due to scales, as suggested by another member. Anyone who has blown soap bubbles will remember that their iridescence only appears in all its splendor when they are *extremely thin;* when first blown, and when the film is (comparatively) *thick*, the iridescence is *slight.* Now, these wings are thicker than the film of a soap-bubble; consequently they *ought* not to be iridescent. I have seen it stated, and from my own observation I believe that the statement is correct, that insects' wings are composed of *two* membranes. These may sometimes be partially separated, and when a wing is *stained* the staining fluid will get between the two membranes. Now, the fact that these two membranes touch one another is suf-

ficient to produce iridescence, just as "Newton's rings" are formed by two pieces of glass when they touch. That the colors are in more or less regular waves confirms this explanation. H. M. J. UNDERHILL.

CLEANING SLIDES.—I. Make a solution of Hudson's Extract of Soap, immerse the slides, and leave for a few days; the balsam, cement, and everything else will clean off beautifully. It is preferable to using vitriol or other strong acids.

J. W. GROVES.

II. I find the following solution very good for new or old slides and cover-glasses:—Bichromate of Potash, 2 ozs.; sulphuric acid, 3 fluid ozs.; water, 35 fluid ozs. Cover them completely with the brown fluid, rinse under a tap, and stand on edge on several thicknesses of blotting-paper. Before mounting on them, the dust should be brushed off with a camel's-hair brush. For new covers, place a few in a wide-mouthed bottle, cover with the solution, shake often so as to separate them. After three or four hours, pour off acid solution, and wash the covers in a bottle with water, pouring on and off until the water is colorless. When wanted, a cover can be taken out of the bottle with a pair of forceps and wiped dry with a linen rag. This plan is useful for even the thinnest covers. V. A. L.

ON THE ORANGE INSECTS.—When a dish of oranges is seen on the table at dessert, the fact is hardly realized that in all probability their surface is the *habitat* of an insect of the Coccus family. This tiny creature is found on the orange skin in every stage of transformation, from the egg to the perfect insect, during the winter months, instead of remaining dormant in the cold weather, as is the case with most of this insect tribe. It would hardly be possible to find a St. Michael's or Tangierin orange that had not hundreds of these little creatures, in various stages of development, on its surface. Lemons, too, are frequently covered. Upon inspection, the skin of an orange will be found to be dotted over with brownish-scarlet spots of various sizes. These specks can easily be removed with a needle, and when placed under a microscope an interesting scene is presented, consisting of a large number of eggs, which are oval, white bodies, standing on end, like little bags of flour, some of

the inhabitants of which may very probably be seen in the process of emerging from the opened end of the egg. The female insect, upon leaving the egg, has six legs, two long hair-like appendages, and no wings; it thrusts its sucker into the orange, in order to obtain nourishment, and never moves again, passing through the various stages of development until it lays its eggs and dies. In the case of the male insect, the chrysalis, after a short period, opens and the insect flies off. The male is supplied with wings twice the length of its body, and each of the legs has hook-like projections. It has four eyes and two antennæ, and is so tiny that it cannot be seen flying. From some parts of Spain, oranges come to us having their rind covered with a coccus of quite a different type. The surface of oranges, indeed, affords the possessor of a microscope an infinite amount of interest and amusement.—Extracted from *Chambers's Journal.*

M. A. HENTY.

A SIMPLE CELL FOR FLUID MOUNTS.—I have lately been using a cell for fluid mounts, which I think will answer, and as it is rather a simple affair, perhaps others might like to try it. Cut cardboard rings (I use gun punches of different sizes for this purpose); the ordinary post-card will be found the most convenient thickness, and place them in patent knotting for a day until thoroughly saturated; then hang them on a cotton line, separating so that they do not touch, in a warm place until thoroughly dry. They can then be put away till wanted for use. To fasten these cells to the glass slips, I make a good ring of gold-size, and press the cell well down into it, then use moderate heat, and put by until cool; the ring should then be securely fastened to the slip. Now examine well to see if air appears under the cell; if so, place more gold-size round, and heat again. After the ring is firmly fastened, I cover it with a mixture of gold-size and oxide of zinc, placing a circle of this cement on the inside edge of the ring. This is a great safeguard against air bubbles. I have had some objects in glycerine fluid in these cells since the beginning of August last, and there is nothing the matter with them yet. The gold-size and oxide of zinc make a capital cement for fluid mounts; it is very safe, and dries well. M. FARHALL, 7 Lorna Road, West Brighton.

(*All the above are from the Journal of Microscopy.*)

REVIEWS.

AN ATLAS OF CLINICAL MICROSCOPY. By Alex. Peyer, M. D. Translated by Alfred C. Girard, M. D. Ninety plates, one hundred and five illustrations, chromo-lithographs. Large 8 vo. pp. 200. D. Appleton & Co. $5.00.

The work is divided into seven parts: Examination of the blood; the mammary secretion; the urine; the sputum; intestinal contents; contents of stomach; etc. The author gives us selections from over four hundred drawings he has made during the past few years. The majority of these are very well executed, while some are not so accurately rendered. There are some subjects elaborated upon out of all proportion to their practical value, while others are but slightly mentioned.

The subject of spermatorrhœa is put in altogether too prominent a way, at least so it seems to us. There are a few glaring errors in the text, as on page 2, when it is stated that "the total quantity of blood is estimated at *one-third* of the weight of the body." But any work is liable to these slight oversights.

The volume will be found of great service to the physician who has faith in his microscope, and is one of the few works offered to him that can be put to practical use every day.

The work of the publishers is of the very best order.

WE TWO ALONE IN EUROPE. By Mary L. Ninde, Chicago. Jansen McClurg & Co. 1886. 8 vo., pp. 350. Illustrated. $1 50.

Two "very joyous, not the oldest nor the wisest" girls take a trip alone to Europe. They spend two years in visiting foreign places of interest. In Berlin, Naples, Moscow, Paris, and Palestine, they were evidently the same two very joyous travelers. It is our unanimous verdict that a more fascinating book of travel was never written. From first to last the reader is surprised at the fresh and vigorous descriptions of places of interest, and at the novel situations in which the authors frequently find themselves placed. Being ladies, too, they were admitted to sights and scenes, where men could not go; as, for instance, to a Turkish wedding. It was a grand wedding at the house of a Bey; and from the description it was evident that their presence was as novel to the wedding guests as the whole scene was to our travelers. It is a book of universal interest.

FOOD MATERIALS AND THEIR ADULTERATIONS. By Ellen H. Richards, Instructor in Sanitary Chemistry in the Massachusetts Institute of Technology. Small 8 vo., pp. 200. Boston, Estes & Lauriat. 1886.

This manual contains the result of some year's experience in laboratory work, determining the extent and character of the adulterations of food materials. Such subjects as water, tea, coffee, sugars, milk, butter, canned goods, and materials used in cooking, are discussed and their substitutes given with the accompanying effects.

The subject of "adulterations" is indeed a large one and should receive the most thoughtful attention of sanitarians. It is a subject that concerns the welfare of the whole people.

MANUAL OF THE BOTANY OF THE ROCKY MOUNTAIN REGION. By John M. Coulter, Ph. D., Prof. of Botany in Wabash College. Ivison, Blakeman & Co. 1885. 8 vo. pp. 450.

In this volume are given all the known flowering plants and vascular cryptogams between the 100th meridian and the western slope of the Rocky Mountains, and between the latitudes of Southern Colorado and British America. Travelers and residents in that region can now readily identify the plants they find. It is after the manner of Dr. Gray's Manual of the Botany of the Eastern United States.

HISTOLOGICAL METHODS. By Simon H. Gage, B. S., Assistant Professor of Physiology, Cornell University.

This manual of methods of work is just in the line of help we all so much need. The question is not *what* shall we do, for we know of too much to do already; it is rather, *how* shall we do it. Such help as Prof. Gage gives us go a great ways toward answering the question so often asked us by our students and still oftener asked by ourselves.

Prof. Gage gives a large number of methods for examining various organs and tissues of the body, as well as giving much aid in certain branches of forensic medicine. All of these methods come directly from Prof. Gage's hand and can be relied upon as correct. Address the author at Ithaca, N. Y.

VIEWS ABOUT THE CITY OF HARTFORD.

A number of beautiful photographs, the gift of our fellow-worker Dr. W. J. Lewis, consulting surgeon for the Travelers' Insurance Co.

KOCH'S METHOD OF STUDYING THE BACTERIA. By T. Mitchell Prudden, M. D., Lecturer on Histology in Yale Medical College.

This is a report to the State Board of Health of Connecticut, and contains a very able account of Koch's methods of work.

THE CENTURY.

The April number is full of the most interesting matter. Three articles describe the cruise of the Alabama. These articles alone are of sufficient interest to make this number exceedingly instructive and entertaining.

EYE OF THE HORSE-FLY.—Mr. J. D. Hyatt, in his studies of compound eyes and multiple images, remarks as a curious peculiarity of the eyes of the horse-fly that the lenses of the upper and anterior part are much larger than those situated below a median line, the larger facets having at least twice the diameter or four times the superficial area of the smaller. The larger lenses form pictures at a plane considerably above the focal plane of the smaller ones. Thus these insects are furnished with eyes of two varieties, corresponding to our long-sight and short-sight spectacles; in other words with telescopic and microscopical eyes, the telescopic looking upward and forward, and the microscopical downward.—*Popular Science Monthly.*

ROCELLIN colors bone, muscle, connective tissue, glands, and epithelium cherry-red; gold or orange serves for fresh or alcoholic or chromic acid preparations. Bone is stained deep orange red, cartilage, gold, connective tissue, reddish; especially valuable for glandular tissue; it gives a splendid appearance to liver injected with Berlin blue, the blue vessels showing on a gold ground; sections of skin give fine results. Preparations after washing and cleaning are best mounted in Canada balsam; oil of cloves is mostly used for clearing, but where the colors are very delicate, use oil of Lavender or quite colorless oil of Aniseed, as the yellow color of the oil of cloves injures them.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR EXCHANGE.—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially esired. ROBT. W. WOOD, JR., Revere St., Jamaica Plain, Mass.

FOR EXCHANGE.—Mounted sections of injected lung of guinea pig.
CHAS. BLASDALE, Jericho, Queens Co., N. Y.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

FOR EXCHANGE—One Fiddian Microscopic Illuminator, one Brass injecting Syringe with four pipes and stop cock, one Microtome (Brass) Rivet, improved, with knife, one Dr. Sellers Section Knife and Carrier, one warm Stage with Thermometer and Gas Chamber in exchange for first class Polariscope with goniometer Eyepiece or collection of thin mounted Rock sections.
DR. HENRY FROEHLING, 17 South 12th street, Richmond, Va.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Popleine, Virg Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

ACARI INSECTS, pathological and other well mounted slides. in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W, WESTOVER, M. D., St. Joseph, Mo.

WANTED.—A copy of No. 1. Vol. IV., The Microscope ; will give slides in exchange, or cash.
Very Truly, HENRY FROEHLING, Richmond, Va.

WANTED.—Unmounted material, any kind ; foram-inifera and diatoms preferred ; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

WANTED.—Good 1-4 ; spy glass ; will exchange good objectives, including new Gundlach 4-10 of 80°. C. OUDERDONK, Rugby, Tenn.

WANTED.—Micrographic Dic'y, 4th ed. Will give Wales 1-10 immersion, 135°.
DR. ED. GRAY, Benecia, Cal.

THE MICROSCOPE.

VOL. VI. ANN ARBOR, MAY, 1886. No. 5.

ORIGINAL COMMUNICATIONS.

BLOOD MEASUREMENTS.

A. WATERHOUSE, M. D., JAMESTOWN, N. Y.

THERE has been considerable controversy within the past few years, in regard to the possibility of distinguishing the blood corpuscles of man from those of some of the lower animals, and assertions have been made that might mislead those who have had no opportunity to make investigations for themselves.

Having made many measurements of blood corpuscles of different animals for several years past, and well knowing that it is more popular to be positive, though in error, than to be sceptical, even where facts will not warrant a positive opinion, I am induced to give you some of my own measurements made during the past ten years.

They have been made under very favorable circumstances, and with great care. I have made many measurements of blood corpuscles in their own serum, in various media, and in other ways, but have yet to find any way in which they change less in size than that of drying quickly upon a clean glass surface, and in preparing my specimens I have used the fresh blood spread upon a thin glass cover so thinly that the corpuscles should not touch each other and become disturbed, and gently warmed so that the blood may dry quickly.

A ring was made with cement upon a slide and the cover inverted upon it, so that the blood is on under side of the cover.

The ring serves to prevent the blood from touching the slide and forms a closed cell excluding all extraneous matter and in this manner will keep for years.

The measurements were made with a fine 1–16 inch objective, and D eye-piece micrometer, giving a magnifying power of about 2,800 diameters. The value of each division of my

eye-piece micrometer was carefully ascertained by a stage micrometer, ruled by Prof. W. A. Rogers to 1–2,500 of an inch, and found to be of the value of .000,035,55+′ or 1–28,125 inches, and I could estimate to one half of one division. The relative length of tube, from eye-piece to objective, was maintained the same, and the collar adjustment was placed at the same point of correction.

I have arranged the measurements in the order of size of corpuscles rather than that of species of animals, as being more easily found and compared in the table.

In comparing these measurements with the wonderful tables of Dr. Gulliver it must be remembered that he took the average of only ten measurements under a magnifying power of only 500 or 600 diameters, and that they were made between 1839 and 1846, when he could not have had as good glasses as are now made, and further that his standard of measure might not have been as accurate as those with which Prof. Rogers is now able to furnish us.

I wish the reader would compare these tables with the measurements of the late Dr. J. J. Woodward in his plates of Blood Corpuscles of Man, Dog, and Guinea Pig, although if the columns of figures in my original measurements be divided into tens or even twenties the variations oftentimes would be greater.

MEASUREMENTS OF BLOOD CORPUSCLES OF MAMMALS.

Fœtus of Grey Gopher.	100 meas.	Max.	.000,497+′	or 1–2,009 in.
		Min.	.000,355+′	or 1–2,812 in.
		Aver.	.000,429+′	or 1–2,328 in.
Indian Elephant.	200 meas.	Max.	.000,426,6′	or 1–2,344 in.
		Min.	.000,302,2′	or 1–3,309 in.
		Aver.	.000,399′	or 1–2,778 in.
Fœtus of Cat (Felis Dom.)	200 meas.	Max.	.000,391′	or 1–2,557 in,
		Min.	.000,284′	or 1–3,516 in.
		Aver.	.000,333′	or 1–2,996 in.
Man.	200 meas.	Max.	.000,355,5+′	or 1–2,812 in.
		Min.	.000,266,7′	or 1–3,750 in.
		Aver.	.000,328,3′	or 1–2,996 in.
Gray Rabbit (Lepus Sylvestris).	200 meas.	Max.	.000,355+′	or 1–2,812 in.
		Min.	.000,284+′	or 1–3,516 in.
		Aver.	.000,326+′	or 1–3,054 in.
Woodchuck, (Arctomy Monax)	200 meas.	Max.	.000,391′	or 1–2,557 in.
		Min.	.000,284′	or 1–3,516 in.
		Aver.	.000,326′	or 1–3,071 in.
Man	200 meas.	Max.	.000,355′	or 1–2,812 in.
		Min.	.000,267′	or 1–3,705 in.
		Aver.	.000,328′	or 1–3,089 in.

Guinea Pig, (Cavia Cobayia).	200 meas.	Max.	000,355+′	or 1-2,812 in.
		Min.	.000,284′	or 1-3,516 in.
		Aver.	.000,323′	or 1-3,090 in.
South American Ape.	200 meas.	Max.	.000,373+′	or 1-2,678 in.
		Min.	.000,249—′	or 1-4,018 in.
		Aver.	.000,325+′	or 1-3,091 in.
Man.	200 meas.	Max.	.000,391′	or 1-2,557 in.
		Min.	.000,248′	or 1-4,018 in.
		Aver.	.000,323,	or 1-3,097 in.
Grey Rabbit, (Lepus Sylv).	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,284+′	or 1-3,516 in.
		Aver.	.000,322+′	or 1-3,107 in.
South American Ape.	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,249—′	or 1-4,018 in.
		Aver.	.000,321′	or 1-3,114 in.
Fœtus of Cat, (weighing about an ounce).	200 meas.	Max.	.000,391′	or 1-2,557 in.
		Min.	.000,284+′	or 1-3,516 in.
		Aver.	.000,320′	or 1-3,120 in.
Man	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,284+′	or 1-3,516 in.
		Aver.	.000,320+′	or 1-3,121 in.
Terrier Dog.	100 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,284+′	or 1-3,516 in.
		Aver.	.000,316+′	or 1-3,128 in.
Grey Gopher.	200 meas.	Max.	.000,462+′	or 1-2,163 in.
		Min.	.000,249+′	or 1-4,018 in.
		Aver.	.000,325+′	or 1-3,130 in.
Man.	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,284+′	or 1-3,516 in.
		Aver.	.000,319—′	or 1-3,136 in.
Water Spaniel Dog.	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,249—′	or 1-4,018 in.
		Aver.	.000,318+′	or 1-3,142 in.
Rabbit, (Lepus Domesticus)	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,284+′	or 1-3,516 in.
		Aver.	.000,317+′	or 1-3,152 in.
Newfoundland Dog	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,302+′	or 1-3,308 in.
		Aver.	.000,317—′	or 1-3,158 in.
Newfoundland Dog.	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,284+′	or 1-3,516 in.
		Aver.	.000,315—′	or 1-3,166 in.
Mongrel Dog.	200 meas.	Max.	.000,356—′	or 1-2,812 in.
		Min.	.000,267′	or 1-3,663 in.
		Aver.	.000,314′	or 1-3,185 in.
Rabbit (Lepus Domes.).	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,284+′	or 1-3,516 in.
		Aver.	.000,310—′	or 1-3,201 in.
Grey Hound.	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,267—′	or 1-3,750 in.
		Aver.	.000,320—′	or 1-3,215 in.
Setter Dog.	200 meas.	Max.	.000,355+′	or 1-2,812 in.
		Min.	.000,249—′	or 1-4,018 in.
		Aver.	.000,309′	or 1-3,232 in.

Grey Rabbit (Lepus Sylv.).	200 meas.	Max.	.000,332—′	or 1–2,960 in.
		Min.	.000,213+′	or 1–4,687 in.
		Aver.	.000,302+′	or 1–3,309 in.
Fox Hound.	200 meas.	Max.	.000,355+′	or 1–2,812 in.
		Min.	.000,249—′	or 1–4,018 in.
		Aver.	.000,295—′	or 1–3,414 in.
Prairie Dog (Cynomus)	200 meas.	Max.	.000,355+′	or 1–2,812 in.
		Min.	.000,231+′	or 1–4,327 in.
		Aver.	.000,289+′	or 1–3,453 in.
Red Squirrel,	200 meas.	Max.	.000,320′	or 1–3,125 in.
		Min.	.000,267′	or 1–3,750 in.
		Aver.	.000,286′	or 1–3,493 in.
Ursus Americanus, (Black Bear).	100 meas.	Max.	.000,320—′	or 1–3,125 in.
		Min.	.000,249′	or 1–4,018 in.
		Aver.	.000,280′	or 1–3,542 in.
Man, (80 years old).	200 meas.	Max.	.000,320—′	or 1–3,125 in.
		Min.	.000,178′	or 1–5,625 in.
		Aver.	.000,252′	or 1–3,562 in.
Star Nosed Mole.	200 meas.	Max.	.000,338′	or 1–2,945 in.
		Min.	.000,178′	or 1–5,625 in.
		Aver.	.000,270′	or 1–3,697 in.
Weasel,	200 meas.	Max.	.000,338—′	or 1–2,945 in.
		Min.	.000,213+′	or 1–4,688 in.
		Aver.	.000,266—′	or 1–3,760 in.
Rat.	200 meas.	Max.	.000,284′	or 1–3,516 in.
		Min.	.000,231′	or 1–4,327 in.
		Aver.	.000,265′	or 1–3,764 in.
Skunk,	200 meas.	Max.	.000,284,4+′	or 1–3,516 in.
		Min.	.000,213,3+′	or 1–4,687 in.
		Aver.	.000,254,9′	or 1–3,928 in.
Chipmuck,	200 meas.	Max.	.000,284′	or 1–3,516 in.
		Min.	.000,231′	or 1–4,327 in.
		Aver.	.000,260′	or 1–3,836 in.
Ass.	200 meas.	Max.	.000,320′	or 1–3,125 in.
		Min.	.000,213′	or 1–4,687 in.
		Aver.	.000,258′	or 1–3,876 in.
Hog.	200 meas.	Max.	.000,284+′	or 1–3,516 in.
		Min.	.000,213+′	or 1–4,687 in.
		Aver.	.000,255—′	or 1–3,917 in.
Little Brown Bat.	200 meas.	Max.	.000,284+′	or 1–3,516 in.
		Min.	.000,231+′	or 1–4,327 in.
		Aver.	.000,253,8′	or 1–3,931 in.
Raccoon.	200 meas.	Max.	.000,284,44′	or 1–3,516 in.
		Min.	.000,213,33′	or 1–4,687 in.
		Aver.	.000,250,48′	or 1–3,978 in.
Red Fox.	200 meas.	Max.	.000,284,4′	or 1–3,516 in.
		Min.	.000,221,1′	or 1–4,329 in.
		Aver.	.000,253,5′	or 1–3,943 in.
Red Fox.	100 meas.	Max.	.000,267′	or 1–3,749 in.
		Min.	.000,213′	or 1–4,687 in.
		Aver.	.000,242′	or 1–4,130 in.
Horse.	200 meas.	Max.	.000,284′	or 1–3,516 in.
		Min.	.000,178′	or 1–5,625 in.
		Aver.	.000,231′	or 1–4,312 in.

Cat.	200 meas.	Max.	.000,266,6′	or 1–3,750 in.
		Min.	.000,195,5′	or 1–5,114 in.
		Aver.	.000,222,9′	or 1–4,469 in.
Cat.	200 meas.	Max.	.000,266,7′	or 1–3,750 in.
		Min.	.000,177,8′	or 1–5.628 in.
		Aver.	.000.217′	or 1–4,591 in.
Chipmuck.	200 meas.	Max.	.000,248,8+′	or 1–4,018 in.
		Min.	.000,151′	or 1–6,250 in.
		Aver.	.000,217,1′	or 1–4,607 in.
Ox.	200 meas.	Max.	.000,231′	or 1–4,327 in.
		Min.	.000,160′	or 1–6,250 in.
		Aver.	.000,199′	or 1–5,008 in.
Sheep.	200 meas.	Max.	.000,213′	or 1–4,687 in.
		Min.	.000,160′	or 1–6,250 in.
		Aver.	.000,179′	or 1–5,593 in.
House Mouse.	200 meas.	Max.	.000,284′	or 1–3,516 in.
		Min.	.000,160′	or 1–6,250 in.
		Aver.	.000,239′	or 1–4,182 in.
Common Goat.	200 meas.	Max.	.000,199,5′	or 1–5,111 in.
		Min.	.000,142,2′	or 1–7,031 in.
		Aver.	.000,165,5′	or 1–6,042 in.

CAM FINE ADJUSTMENT.

BY EPHRAIM CUTTER, M. D., NEW YORK.

FOR years I have sought to simplify the mechanism of the compound microscope so that a really good instrument might be had for less money—not for the sake of doing away with the magnificent mechanisms now extant, but for *paving the way* for them by making *microscopes* as plenty and popular as *pianos and organs.* This contribution is one effort in this direction.

Two ideas are involved—

1. To have a cam or cams at the distal end of stage which is a steel or brass plate fastened to the proximal end of bed plate of stage.

2. To have four cams, one at each angle of the quadrangular stage, which is drawn down to the bed plate of stage by springs beneath, suggested by the late Dr. Louis Elsberg.

The advantages of the cam fine adjustment for stage or tube of microscope are—

1. Simplicity.
2. Cheapness.
3. Effectiveness.
4. Less trouble from wear.

1. *Simplicity*, as compared with the screw fine adjustment. A screw adjustment is a double faced projecting spiral inclined plane wound on a shaft. This plane runs on another re-entrant double spiral inclined groove winding around the inside periphery of a hole or shaft usually fixed. For use on the microscope stage the screw adjustment must not wabble, yet it must move readily and have no loss of motion upwards or downwards, inwards or outwards. Experience has taught me that it takes a skilled mechanic to make a good fine screw adjustment. For ordinary screw threads the requirement is to bind in one direction but not in the other direction. Such screw threads illy answer for moving backwards and forwards with the accurate delicacy of such an instrument of precision as the compound microscope. It is then expensive to make a fine screw adjustment and there are few workman that can make them.

On the other hand the cam adjustment is easily made by centering a metallic disc, outside of the true center, on an axis of steel wire. It is simple to mount. Even an unskilled artisan can make and mount it.

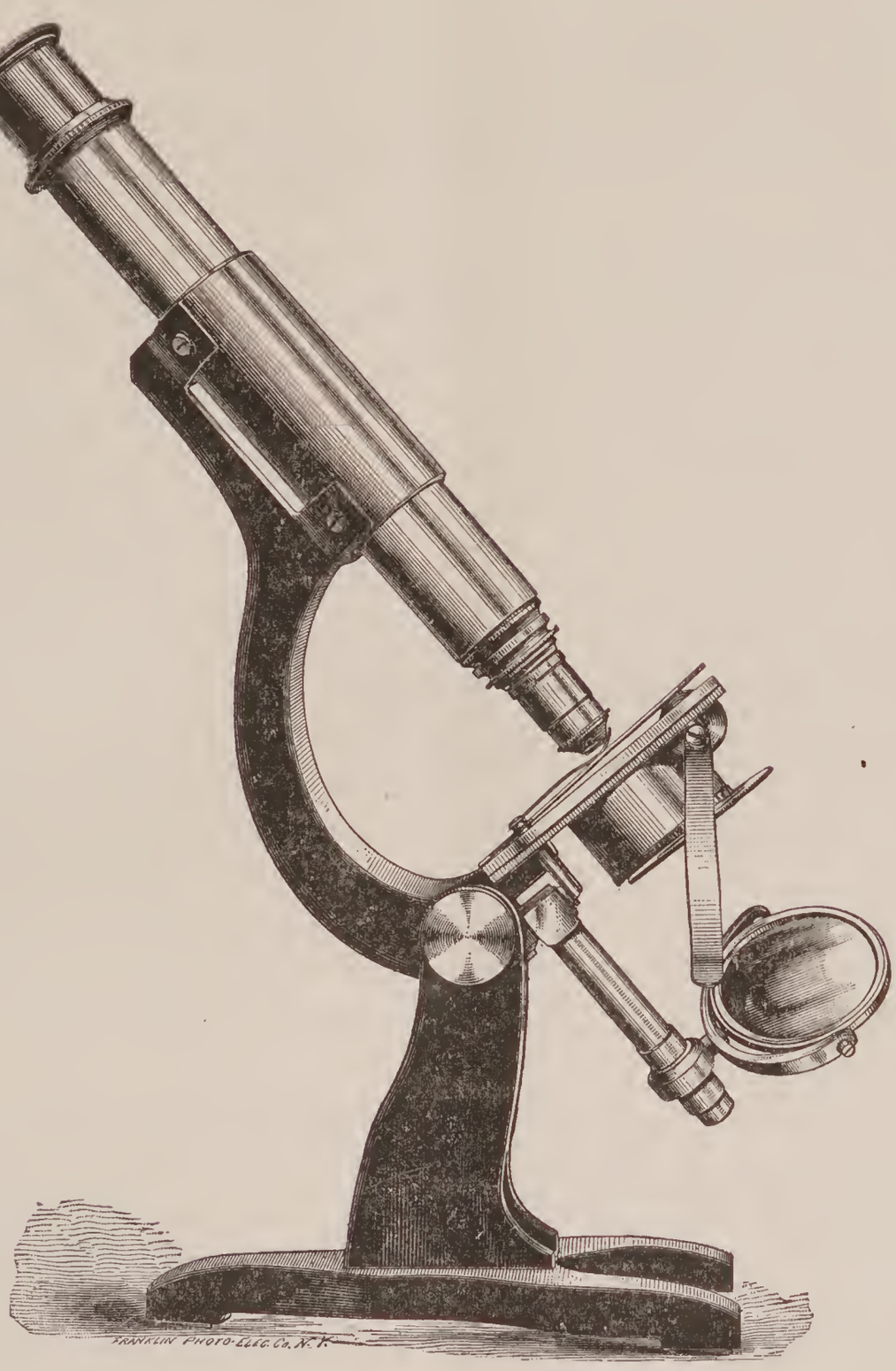
2. *Cheapness.*—Nickel five cent pieces may answer for cams. These have a smooth rim and a good place to bore a new center in the upper part of the shield on the "In God we trust" side of the coin.

Besides it is inexpensive to turn out a like disc on a lathe.

3. *Effectiveness.*—No mechanical motion is so sure and effective as that of a cam. A short lever attached to the axis of the cam gives the means of applying required motions with ease and certainty. The amount of motion can be regulated exactly. It is rapid and sensitive. What more could be asked for a fine adjustment?

4. *Not liable to get out of order* as the spring or springs holding the stage to the stage plate keep the parts in contact together, and compensate for the loss by wear which is on one surface in one direction, to-wit, downwards; while the wear of the screw is on two surfaces in two directions, to-wit, upwards and downwards. In the hands of an active worker this wear of a screw makes an unpleasant loss of motion in two directions, and which it is not easy to remove in the case of a screw. I

claim that the cam gives the minimum of trouble for wear and loss of motion thereupon.



Distal Cam fine adjustment adapted to the Students' Microscope of the Boston Optical Works, by the writer.

In this cut the stage is represented as arranged for use, so that it can be elevated or depressed. When not in use the cam lever is turned so as to lie parallel with the stage, and the stage is not put on a stretch.

The object is placed on the stage, the coarse adjustment made and followed by the fine adjustment.

Objections have been made to this form of adjustment. One English writer has characterized as "barbarous" the inclination of the stage.

Let us see how "barbarous" it is.

1. I have used it successfully with objectives as high as Tolles' $\frac{1}{10}$, 4 system, 180° angular aperture immersion objective.

2. On calculation I find the elevating of this distal tangential point of the field over the proximal tangential point of the field is, for a $\frac{1}{5}$ inch objective about $\frac{1}{3200}$ inch.

3. Again from the difficulty I have had with stages of ordinary microscopes in the use of my Tolles $\frac{1}{75}$ inch objective I judge that some stages must have a considerable inclination from a horizontal line exactly at right angles with the tube axis. So that practically a truly square stage at a right angle absolutely perfect, with the tube axis, is not always found even among microscopists—civilized as in America.

4. However, to obviate all annoyance from this objection the late and lamented Dr. Louis Elsberg, of this city, suggested and I have adopted the idea of multiple cams, one at each corner of the stage; the two distal cams being on the same axis and the two proximal cams on the same axis. Rod or rods connect the arm levers and springs hold down the stage on the bed stage plate. The combined action of these cams gives horizontal motion.

5. The late Robert B. Tolles sent out many microscopes with the inclined stage and approved of it. A man who made such improvement and splendid work in microscopy could not be called a "barbarian." Still after this presentation if any one chooses to call me "one" I think I can stand it. It may be said many microscopists (Mr. Tolles among the rest) have been as bad if this was not a new idea, and all said it was save Dr. Salisbury, of this city, who said that the late Dr. J. Lawrence Smith, of Louisville, Ky., advanced the same idea some years ago.

We would call attention to the new advertisement of Mr. Zentmayer. He now offers some unusually fine apparatus, and at a price within the reach of all.

PROTEROSPONGIA PEDICELLATA.

DR. ALFRED C. STOKES.

IN the *Journal of the Royal Microscopical Society* for August, 1884, Mr. Frederick Oxley describes a new member of Proterospongia, a genus of social collar-bearing monads, the chief peculiarity of the species being the posteriorly developed pedicle, on account of which he named the creature *Proterospongia pedicellata*. The Choano-flagellata, or collar monads, have as yet attracted but little attention in this country, although few among the microscopic animals of the water are more graceful or beautiful. Their excessive minuteness, however, and the consequently high amplification needed for their study or even for their ordinal recognition, are not in their favor, although when once positively observed, the characteristic collar encircling the base of the flagellum can be demonstrated with a low power objective. One of Tolles' superb $\frac{4}{10}$ths is usually an efficient aid in seeking them, well defining the flagellum and the lateral borders of the collar-like membrane of many of them.

Proterospongia is of unusual interest since the result of its reproductive fission is the formation of a colony whose members are united in a mucilaginous zoocytium secreted by themselves. In this almost invisible mucus the zooids are wholly immersed with the exception of the collar and flagellum, which project into the water where the colony freely swims. Before Mr. Oxley discovered his *pedicellata* there was but one known species, *Proterospongia Haeckeli*, S. K. which, so far as I am aware, has not been found in our waters, Mr. Oxley's species differing from the latter chiefly in the size of the colonies and in the presence of the short pedicle already referred to. This pedicellate form I have recently obtained in considerable abundance, taking it about the middle of March from a small pond, in company with Lemna, many species of Closterium, diatoms, infusoria and aquatic worms. The colonies vary in size from a minute cluster of three or four members, to floating concavo-convex films one-fiftieth inch in diameter and containing thousands of zooids, agreeing with Mr. Oxley's statement that "the number of individuals composing a colony amounted from 10,000 to 20,000 or more."

The measurements of my specimens closely correspond with those of the English; much more closely indeed than is usually the case, according to my experience, with American infusoria that are otherwise undoubtedly identical with the European. The body is about $\frac{1}{3000}$ inch long, obovate or subspherical, the flagellum nearly seven times as long, and the collar about $\frac{1}{1500}$ inch in height. The pedicle is rather shorter than the measurement ($\frac{1}{10000}$ inch) given by Mr. Oxley, but it is conspicuously developed.

Reproductive fission takes place rapidly, and the colonies consequently increase speedily in numbers and size. On the evening of the day when the gathering was made, two large clusters were captured at the first plunge of the dipping tube; two days later the number had apparently doubled.

The observer will not soon forget his first glimpse of a large colony of these colorless creatures apparently floating side by side but widely and evenly separated by an investing invisible something, the wondrously long flagella lashing the water, the conical collars erect and expanded, and the two little posterior contractile vacuoles alternately snapping themselves out of sight; and although I have nothing new to add to Mr. Oxley's observations, I record the first capture of the species in this conntry as an interesting occurrence of a European form far from the habitat in which it was originally discovered.

THE MICROSCOPE AND THE TELESCOPE.

A FRIEND wrote us asking "What is the difference between the microscope and the telescope." We asked Prof. M. W. Harrington, of the Astronomical Observatory, to answer the question for us, which he does as follows:

"These two instruments, constructed on identical physical principles, differ in their details because of the relative position of the object viewed. In the microscope the object is very near, in the telescope very far; in the first the rays of light utilized are very devergent, in the second the rays are practically parallel. Perhaps the simplest view of the telescope is that it is a microscope reversed. In the telescope the eye is at the small end where the most of the magnifying is done; in the

microscope the eye is at the large end where there is the least amplification.

Another relative view of the instruments is that the telescope is a microscope plus an apparatus to bring the distant object near enough to examine it with a magnifier. The telescopic object-glass forms an aerial image, of the heavenly body examined, in the focus of the magnifier, and this intangible image is examined as if it were a material thing. From this point of view the telescopic eye-piece is the microscope and could be replaced by an ordinary compound instrument. That is not only theoretically but practically true, and I have tried it. My success was not remarkable but it was sufficient to show that the present telescopic eye-pieces could be profitably replaced by suitable microscopes. I suggested it to a prominent instrument-maker and I have reason to think he has been experimenting on it.

A peculiarity of the microscope, not participated in by the telescope, is that the former utilizes diffraction—seeing while the latter does not. This characteristic of the microscope is a recent discovery of Prof. Abbe, of Germany. An account of it can be found in his publications and in the *Journal of the Royal Microscopical Society*."

RESULTS OF MICROSCOPICAL RESEARCH.

CIRCUMSTANCES beyond the control of the editor necessitated an interruption in this series of abstracts since the beginning of last year. He now hopes that they may be frequently presented to his readers. The abbreviations of the names of the journals quoted from are indicated in the last volume.

Suckers of the Lump-suckers.—Several genera of marine fishes are characterized by the presence of a sucker on the lower surface, by means of which they are enabled to adhere to stanes, etc. Mr. Maurice Stuckens (Bull. l'Acad. Roy. Belg. III, viii, 74–84, 1884) describes the structure of these suckers in the genus *Liparis* making comparisons with the normal structure of the fins in the perch and illustrating his results by a plate.

The Head-kidney of Polygordius.—Three genera of worms

(*Polygordius*, *Protodrilus*, and *Saccocirrus*) have recently acquired great prominence as they are to be regarded as the modern representatives of the ancestors of the more common chætopods. They have been studied principally by Hatschek, a Hungarian naturalist, who described a segmental organ as existing in the head. Recently Fraipont, who has been studying at the zoological station at Naples, has shown that this head-kidney does not communicate with the cœlom and that the funnel of Hatschek is but a membrane supported on slender tubes. This structure is shown to be exactly comparable to that existing in *Echiurus* and furnishes another reason for removing that genus from the Gephyreans and placing it among the Annelids. The comparison is also suggested that the larger nephridial tube and the smaller supporting cæcal tubes are the representatives of the larger and smaller canals of the so-called water-vascular systems of rotifers and plathelminths.

The Sucking-pharynx of Arachnids.—Within a few years the spiders and their allies have been recognized as very important from a systematic standpoint and their anatomy has been carefully investigated by several students. Among these is Dr. J. MacLeod who in a recent paper describes (Bull. Acad. Belg. III, viii, 377) a sucking portion in the pharynx anterior to the passage of the œsophagus between the œsophageal commissures of the nervous system. This is best developed in the scorpions where the system of radial and circular muscles is well developed. It also exists in a rudimentary condition in the true spiders which, as is well known, are provided with a sucking stomach. The sucking pharynx is most rudimentary in the false-scorpions (*Chelifer*). Mr. MacLeod also shows that there is a coxal gland in the harvest-men (*Phalangids*) and instances a case of hermaphroditism in the genus *Trombidium*.

Origin of Nerves.—Professor Kölliker, in the course of an article on Histological Studies on Batrachia (Z. w. Z. xliii, p. 1, 1885) throws considerable light on the origin of nerves. He finds that in the tails of very young tadpoles a few nerve filaments are sent out from the neural cord to the peripheral portions of the body. These have but few branches and lack the medullary sheath. Soon other filaments grow out and join the first and more branches are formed, thus producing an anasto-

mosing condition. Soon scattered nuclei, derived from the connective tissue, appear at the sides of these filaments. These are next surrounded by protoplasm, and finally they surround the nerve filaments, and then, elongating, give rise to the medullary sheath. Ranvier, some years ago, showed that the sheath was probably mesodermic in origin, but it was left for Kölliker actually to demonstrate the fact and to show that the 'nodes' actually represent the limits of the investing cells. This paper is also important from the fact that it shows that all nerves are outgrowths from the neural cord and do not pre-exist in the connective tissue in an undifferentiated condition.

Taste in Insects.—F. Will has recently investigated both experimentally and histologically the organs of taste in insects. The organs are found on the tongue and mouth parts, and consist of numerous cells each with its nerve supply and each, like all sense organs (except eyes) of Arthropods, terminating in a bristle. A detailed account would not be intelligible without numerous illustrations. The experimental proof that these are really organs of taste is conclusive. Among other tests, the author accustomed wasps to coming for sugar and then replaced this with alum. This they tasted of but immediately retreated, and with the "drollest motions" tried to clean their tongue with the feet. Other experiments, conducted under the compound microscope, were even more conclusive. The article will be found in the Zeitschr. wiss. Zool. xlii, y. 674, 1885.

Development of the Ascidians.—Van Beneden and Julin have three papers on the development of the Ascidians in the volumes for 1884 (vols. vii and viii) of the Bulletin of the Royal Academy of Belgium. One details the relations of the nervous system of the adult with that of the larva; the second describes the manner of formation of the branchial aperture and the cloaca; while the third is concerned with segmentation and gastrulation. It contains a complete genealogy of the cells from the egg until segmentation results in forty-four cells. The authors claim that with the first division the right and left halves of the animal are distinguished; the second segmentation separates the anterior and posterior cells, etc., the steps of development taking a mathematical character, until at the formation of the gastrula the authors claim to be able to point out exactly what

cells give rise to mesoderm, notochord nervous system, etc. Did they describe the methods by which certainty was obtained, one could have more confidence in the results.

The Green-gland of Crustacea.—There exists at the base of the second antenna in most Crustacea a peculiar gland known as the "green-gland." In the older works this was regarded as an ear, but more lately it has been regarded as urinary in its nature. This is now proved, as Mr. A. B. Griffiths (Proc. R. S., xxxviii, 1885) has extracted from it uric acid crystals. In all probability the gland is to be regarded as a remnant of a series of segmental organs of which there was one in each segment in the ancestral worms from which the Crustacea were derived. Concerning segmental organs reference may be had to the next note.

Segmental Organs of an Earthworm.—Until recently it was believed that no worm had more than a pair of segmental organs in each segment, but Eisig showed that in the peculiar worms known as Capitellidæ this member might be excluded. More recently Mr. F. E. Beddard (Proc. Roy. Socy., xxxviii, 1885) described the segmental organs in an earthworm from Australia, where each segment has eight segmental organs, one opening at the base of each seta. The seta are not arranged here as in our familiar earthworm but are widely separated. The exact explanation to be given for this anomalous condition is not readily ascertained.

Function of the Thymus Gland.—Victor Horsley (Proc. Roy. Soc., xxxviii, 1885) comes to the conclusion that the function of the thymus gland is concerned in the nutrition of the brain, the existence of mucin in the blood, and the composition of the blood. Nothing accurate was known on these points until 1883, although it had been noticed that the extirpation of the gland in cases of goitre was followed by cretinism, a fact which naturally led to the supposition that it exercised some influence on the supply of blood sent to the brain.

The Hydroid stage of Limnocodium.—Some years ago a medusa suddenly appeared in the tanks in which the great South American water-lily (*Victoria regia*) was kept in the Kew Gardens. It of course excited no little interest, as it was the only fresh-water jelly-fish known. Whence it came is abso-

lutely unknown, though there is every reason to believe that it was introduced with a pond-weed. Its structure was such as to lead one to believe that it had a hydroid condition, and last year Mr. A. G. Bourne found in the tank a number of hydroids, which, there is every reason to believe, is the other stage of the species. It is very small and is even more simple than *Hydra*, for it has no tentacles. Figures of this Hydroid and details of the dates of its appearance may be found in the Proc. Roy. Soc., xxxviii, 1885.

EDITORIAL NOTES.

THE NEW OBJECTIVES.—All our readers will be greatly interested to hear more about the "New Objectives" mentioned in an editorial in our last issue. We, therefore give them the benefit of an article in the April number of the Journal of the Royal Microscopical Society.

MR. GUNDLACH'S OBJECTIVES.—We. have had in our possession, for some time, one of Mr. Gundlach's one-tenth water immersion objectives of 105° angular aperture (water), with a working distance of about 1-50 inch. The glass is listed at $26, and is composed of three systems. Taking the above facts into consideration it is one of the best glasses of its kind we have ever seen and would call particular attention to it as a very desirable working lens.

MR. WALMSLEY'S VISIT.—We have been enjoying a short visit from Mr. W. H. Walmsley, of Philadelphia. Mr. Walmsley always brings good cheer and a store of new ideas. We were simply charmed with the beautiful products of his work in photo-micrography and general photography. Taking together his own skill, the Beck lenses, and the bromide paper, and we have apparently the three essential things to make Amateur Photography a complete success. We shall invest in two of these essentials and shall get as much of the third as Mr. Walmsley can impart to us. He says he is selling hundreds of their new "Star" microscopes and all purchasers declare it "the best cheap microscope in the market." We clip the following from the Photographic Beacon concerning his work in Photo-microg-

raphy: "We have before us a dozen photo-micrographs, by W. H. Walmsley, of Philadelphia; direct prints from negatives, apparently on bromide paper, and varying in size from $2\frac{1}{2}$ to $5\frac{1}{2}$ inches in diameter, including diatoms, leaf hairs, transverse sections of plants, etc. This, while one of the most difficult, is at the same time one of the most delightful branches of photography, and though we are well acquainted with the exquisite work of the most successful workers in England, we have seen nothing better, and doubt whether anything equal, to those now on our table. Where all are so excellent, it is difficult to discriminate, but a section of the stem of *Eclimus esculentus*, one of *Clematis Virginiarum*, and a specimen of *Volvox globator*, are as near perfection as with our present optical appliances we may hope to come. We strongly advise those of our readers, who are interested in photo-micrographic work, to procure a few of Mr. Walmsley's specimens as something worthy of being wrought up to."

SELECTIONS.

THE NEW OBJECTIVES.

For some months past it has been known that we were on the eve of an important advance in objectives, depending mainly on the elimination of the secondary spectrum, leaving only a small tertiary spectrum. We alluded to the subject at the Anniversary Meeting, by way of supplement to the remarks of the President on the great value which he had found an increase of aperture to be in his researches on very minute organisms with high powers, and we expressed the belief that the new objectives will be found to be of at least equal advantage.

Two objectives have now been received in this country, and their examination has fully borne out the expectation formed of them, and has shown that however trifling the improvement might at first sight be thought to be on theoretical grounds,* it

* Prof. Abbe writes us on this point, "We have now made what I called in 1878 'the Microscope of the future,' i. e. objectives which admit of a more perfect concentration of all the rays from the object. If now (as I am nearly sure they will) microscopists should feel somewhat disappointed at being told that 'the Microscope of the future' is nothing more and nothing better in principle than these objectives, I must answer 'It is not *my* fault that at this time microscopical optics is such an ungrateful domain of human work, that many years' hard labour have no other result than a slight advance."

is very distinctly appreciable, so that the high power work of the future will almost necessarily be done with these glasses.

The objectives in question are both $\frac{1}{8}$ in. The special point in their construction is that they are made of new kinds of optical glass, which Prof. Abbe and Dr. Shott have been working for the last five years to perfect. The objectives are composed of ten single lenses, combined to five separate lenses, with a single front lens. Their working distance is 0.25 mm., and in order to secure this the aperture is limited to 1.40 N. A. With the length of tube engraved on the setting (taken from the nose-piece to the eye-lens), the objectives have their best correction for a cover-glass of 0.16–0.18 mm. Much thinner covers require a lengtheniug of the tube by 10–25 mm. further. They are very sensitive in regard to length of tube, and the change in this length is the simplest, and in fact the best, means for slight corrections for different covers—the reason being that a change of that kind does not alter the proper balance of the various corrections (spherical, chromatic and sphero-chromatic), whilst an alteration in the distance of the lenses of the objective from one another, as is done by a screw-collar, does disturb that balance to the injury of the performance of the objective. It may be possible to find a formula which will be less sensitive in regard to this question of correction, but until it is found, Dr. Zeiss, by whom the objectives are made, will not supply any with correction-collars, so as to convert a good objective into a medium one for the sake of a non-essential convenience only.

A novel point in counection with the objective is that its performance is improved by the use of special eye-pieces, of which two are supplied, of 25 mm. and 15 mm. focal length. Their function is to compensate for certain aberrations *outside* the axis, which cannot be compensated for in the objective. With these eye-pieces, particularly with that of 25 mm. focal length, the field of view is surprisingly uniform.

Of the ten lenses of which the objective is composed, two only are of siliceous glass, the other eight being made of borates and phosphates. The crown and flint glass now used by opticians does not contain (as essential components) more than six

chemical elements, O, Ca, K, Na, Pb, and Si, whilst the new objective contains not less than fourteen elements.

The optical principle on which the objectives have been constructed is indicated in a paper by Prof. Abbe in this Journal. "On new methods for improving spherical correction," &c. In fact, all the work of Prof. Abbe and Dr. Schott during the five years has been solely directed to finding the proper means for the realization of the desideratum there mentioned, viz. doing away with the secondary chromatic aberration, and with the chromatic difference of spherical aberration. The proper means was found in special kinds of glass, which allowed of *proportional* dispersions in different parts of the spectrum, and which at the same time exhibit different relations between the refractive indices and dispersive powers. By these means a more perfect concentration of all the rays emanating from the object is obtained. With the old kinds of crown and flint glass *two* different colours only could be collected to one focus, a secondary spectrum remaining uncorrected, whilst the new objectives collect *three* rays of different colors to one focus, leaving a small tertiary spectrum only. Moreover, spherical correction has hitherto been confined to rays of *one* color, being made for the central part of the spectrum, the objective remaining *under*-corrected spherically for the red rays and *over*-corrected for the blue rays. In the new objectives, however, the correction of the spherical aberration is obtained for *two* different rays of the spectrum, that is practically for all colours at the same time, and the objective shows the same degree of chromatic correction for the central as for the marginal part of the aperture. All this requires greater complication in the construction, hence the use of five lenses instead of the four hitherto employed. In addition, uniformity of amplification by the various zones of the clear aperture has been obtained in a higher degree than could hitherto be done.

The objectives will be specially useful in photo-micrography where the correction of the secondary spectrum will be found of considerable practical advantage. Not only is there no difference in the optical and chemical foci, but the image formed by the chemical rays is in itself much more perfect. This advantage is very clearly verified by experimental trials which have

been made. For photo-micrography a third eye-piece magnifying $2\frac{1}{2}$ times is supplied, the lenses of which can be slightly separated for exact adjustment of the image.

Two series of objectives will be constructed, one adapted for the short Continental body-tube and the other for the long English body-tube, and there will be a corresponding "compensating" series of eye-pieces. The homogeneous-immersion lenses will have apertures of 1.40 N.A. and 1.30 N.A., and focal length of 3.0 mm. and 2.0 mm., the latter with much increased working distance. The water-immersion lenses will have an aperture of 1.25 N.A. and a focal length of 2.5 mm., and the dry lenses 0.95 N.A., 0.60 N.A., and 0.30 N.A., with focal lengths of 4 mm., 8 mm., and 16 mm.

We append what will we think be of interest to many of the Fellows, a brief account of what we understand to be the history of the construction of the new glass, though, as we have not been able to submit it to Prof. Abbe, he must not be understood to endorse it in any way.

The origin of the matter was Prof. Abbe's Report on the Microscopes of the South Kensington Exhibition published in 1878. This contained at the end some general considerations as to the unfulfilled requirements of practical optics in regard to the properties of optical glass, and complaints of the unfavourable conditions then existing. Dr. O. Schott (of Witten, in Westphalia), a chemist, but long versed in practical glass-making, and who had made some remarkable researches on the physical properties of glass, read the report, and in the beginning of 1881, having communicated with Prof. Abbe, they commensed a preliminary study of the optical properties of the various chemical elements as far as they admit of "vitrificable" combinations. This was conducted at first on a very small scale, Dr. Schott working alone at Witten, and the optical parts of the research being carried out at Jena. After a year it was decided to continue the experiments on a larger scale, with the object not only to determine the optical effects of various elements, but to try the production of practically useful combinations. In January 1882, Dr. Schott settled at Jena, and he and Prof. Abbe established a complete melting-laboratory with large gas-furnaces, a gas engine for driving blowers, etc., and with the aid of

two assistants for the chemical and the optical part of the work, and of several workmen, the experimental research was continued there for two years.

The general direction of the work was based on the principles indicated in the Report of 1878, and in the paper in this Journal before mentioned. According to these principles, there were *two* distinct objects:—(1) To obtain a greater variety of the optical properties of the glass in regard to the relation of the refractive to the dispersive power. The existing kinds of optical glass constituted nearly *a line*, i. e. the dispersion increasing always with the refraction, with very slight deviations only. The object was to combine glasses which, if arranged according to n and Δn, would *not* be confined to a linear series, but would embrace an *area* of a certain breadth, one value of n admitting various values of Δn, and *vice versâ*, as far as possible.

(2) The second problem was:—To procure kinds of glass of different relative dispersions, in which the dispersions should be *proportional*, as near as possible, in different parts of the spectrum (the problem of "secondary chromatism").

In regard to the general research, Prof. Abbe and Dr. Schott had a predecessor in the late Rev. W. Harcout, who worked at the subject in conjunction with Prof. G. G. Stokes. They could not, however, use his results, as all that was published about them is very fragmentary and very indefinite, and they were obliged to begin quite anew. Nevertheless, one important fact was brought to a practical result, viz. the very peculiar property of boracic acid in regard to the second problem, the new observations being only a confirmation of Prof. Stokes's account of glass-samples produced by the Rev. W. Harcourt (though in other essential points the results do *not* confirm the statements of Prof. Stokes).

Dr. Schott had succeeded, after the first months of his melting at Witten, in obtaining fusions of very small quantities—down to 100 grammes—with a remarkable degree of homogeneity, admitting of an exact measurement of the refraction and dispersion by means of spectrometric observation. This was the very best basis of advance, because it allowed of a continuous and strict co-operation of the chemical and optical research.

Every change of chemical composition could be immediately controlled, in regard to the optical effect, by measurement.

The fusions were obtained by means of gas-furnaces, and with crucibles of very different kinds—a great number with platinum crucibles and tools—in quantities of from 50 grammes to 12 kilos, according to the particular object, nearly all chemical elements being submitted to trial; there is even glass containing 10 or 20 per cent. of *mercury*.

A large number of analyses had been executed by the assistants up to the end of 1883, and more than 600 prisms were ground and measured by the spectrometer. Since then this figure has reached 1,000. As it would have been detrimental to the progress of the work to depend on the weather, the spectrometer measurements were always made by means of the five *bright* lines, Kα, Hα, Na, Hβ, Hγ, after the methods described in Prof. Abbe's paper, 'Neue Apparate,' etc.

There were innumerable difficulties to be overcome in order to obtain compositions which should not only show the optical properties desired, but at the same time fulfil so many other requirements for optical glass; and many repeated trials were necessary for one and the same subject before a satisfactory result could be obtained. It is due to the ingenuity and energy of Dr. Schott that these obstacles were overcome.

Towards the end of 1883, Prof. Abbe and Dr. Schott had exhausted the programme, as far as appeared possible in a laboratory-research, and were about to close the affair, and publish the results, as showing the possibility of a series of new kinds of optical glass, and thereby giving an impulse, as was hoped, to its manufacture. At this period, however, several distinguished astronomers and physicists who had taken notice of these researches, encouraged them to go one step further, and to undertake the practical utilization of the results in the way of manufacture. Through the aid of these gentlemen a subsidy was obtained from the Prussian Government (though Jena is not in Prussia) to continue the experiments, so as to establish a manufacture of optical glass, which did not exist in Germany. Messrs. Zeiss, who had already furthered the work, since the beginning, in the most liberal manner by putting all the personal and technical resources of their establishment at Prof. Abbe and

Dr. Schott's disposal, united with them, and in the beginning of 1884 glass-works were set up, with a large furnace and machinery. The Prussian Government's subsidy was 3,000 *l.*, and given under conditions as liberal as any Government has ever granted when putting public money into the hands of private persons.

The new furnace was lighted in September 1884, and since that time Dr. Schott has been actively engaged, almost day and night, in overcoming the difficulties of the operations. The experiences of other manufacturers being inaccessible to a new competitor, everything had to be learned anew. A year later, the first part of the matter was brought to an end—the production of the ordinary siliceous glass, and this, since last autumn, is used by nearly all German opticians. In a few months, it is hoped, that the borates and the phosphates will also admit of regular production, and then the Jena manufactory will be opened for the supply of optical glass on a strictly scientific basis.

This extension of the work has had the effect of delaying the introduction of better glass into microscopical optics by more than two years. In the summer of 1883, sufficient materials had been obtained for the construction of microscope-lenses, and, in fact, the first objectives were made by Messrs. Zeiss at that period, but after it had been decided to establish a manufactory with the aid of public money, Messrs. Zeiss were obliged to abstain from using the new glass, and to wait until the latter should be accessible to other opticians also.

At present the objectives are not on sale, but it is expected that very shortly both objectives and glass can be purchased in the usual way.

Mr. E. M. Nelson, who has had our objective under examination, writes as follows :—

"The great benefit which will accrue to microscopists from the use of lenses of this construction will be due, not so much to the absence of color as to the great freedom from spherical aberration. In other words, these lenses will stand illuminating by axial cones of larger angle. This is evident from the performance on *Navicula rhomboides* (Cherryfield). This diatom, which under oblique light is a test for a $\frac{1}{4}$ of 90°, becomes a pretty severe test for the widest-angled homogeneous-immersion

objective under a large axial cone; in the former case only crossed striæ, or checks could be made out, but in the latter the minute grating should be clearly seen.

This minute grating I have never seen so sharply defined as with this new objective when illuminated by Powell's achromatic condensor with full aperture. It shows the following very delicate objects most distinctly: fracture through the delicate perforated membrane inside the large areolations in *Isthmia nervosa*, and the fracture through the still more minute perforations inside the hexagonal structure of *Triceratium favus*. This last object may be termed the highest test to which the 'microscopy' of the present day can be subjected. Those interested in oblique light will be glad to hear that the striæ on *A. pellucida* come out sharper than I have ever seen them before. The valve is resolved from tip to tip, showing that the lens is flat in its field. To sum up, this lens is decidedly the most brilliant objective I have ever seen. . . . After mentioning the above tests, it is almost unnecessary to say that bacteria, stained and mounted in balsam, are most clearly defined."

Mr. Nelson subsequently wrote us that he had discovered a very minute perforation on the interior lining membrane of *Eupodiscus Argus*. This diatom consists of two separate membranes. The outer one has a brown tint with transmitted light, but appears white and sparkling, not unlike loaf sugar, with reflected light. This outer membrane has large and for the most part oval areolations all over it, the interspaces being granulated. The inner membrane, which is very transparent, has rows of comparatively large white dots radiating from the centre of the diatom. The whole of this inner membrane between these white dots is covered with very minute perforations. These perforations are often arranged in circular rows round the white dots, and are, in reality, "tertiary" markings.

There is, so far as he is aware, no record of a "tertiary" marking on a diatom having been observed before.—*Journal Royal Mic. Soc.*

MOUNTING TONGUES OF FLIES.—Flies may be made to protrude their tongues by dropping them into spirit of wine. They die with the tongue well extended, and the death is probably as humane as any other.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

FOR EXCHANGE.—Fiddian Microscopic Illuminator, brass injecting syringe, Dr. Seilers section knife, warm stage with thermometer and gas chamber, "Archiv für Microscopische Anatomie," bound; in exchange for first class Polariscope, collection of thin, mounted rock sections or collection of minerals—would also exchange for books, geological reports, or books on Mineralogy, Lithology and Geology. HENRY FROEHLING, 17 South 12th Street, Richmond, Va.

FOR EXCHANGE.—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially esired. ROBT. W. WOOD, JR., Revere St., Jamaica Plain, Mass.

FOR EXCHANGE.—Mounted sections of injected lung of guinea pig.
CHAS. BLASDALE, Jericho, Queens Co., N. Y.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

FOR EXCHANGE—One Fiddian Microscopic Illuminator, one Brass injecting Syringe with four pipes and stop cock, one Microtome (Brass) Rivet, improved, with knife, one Dr. Seilers Section Knife and Carrier, one warm Stage with Thermometer and Gas Chamber in exchange for first class Polariscope with goniometer Eyepiece or collection of thin mounted Rock sections.
DR. HENRY FROEHLING, 17 South 12th street, Richmond, Va.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

WANTED.—Diatoms on Algæ or in muds from all the tropical sea shores, especially from Puget Sound, Pensacola, Campeach Bay, Tampa Bay, and fossil earths from Petersburg, Poplcine, Virg Rappahanock Cliff, Piscataway. New and old Nottingham, Maryland. Will give cash or beautiful diatom material from Europe in exchange.
J. C. RINNBOCK, Wien, Simmering 14, Austria.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W. WESTOVER, M. D., St. Joseph, Mo.

WANTED.—A copy of No. 1. Vol. IV., The Microscope; will give slides in exchange, or cash.
Very Truly, HENRY FROEHLING, Richmond, Va.

WANTED.—Unmounted material, any kind; foram-inifera and diatoms preferred; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

WANTED.—Good 1-4; spy glass; will exchange good objectives, including new Gundlach 4-10 of 80°. C. OUDERDONK, Rugby, Tenn.

WANTED.—Micrographic Dic'y, 4th ed. Will give Wales 1-10 immersion, 135°.
DR. ED. GRAY, Benecia, Cal,

THE MICROSCOPE.

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ORIGINAL COMMUNICATIONS.

A FOOD-HABIT OF A CHILODON.

DR. ALFRED C. STOKES.

IN a sloping meadow near the writer's home a little spring bubbles and boils and tosses aloft a miniature sand cloud, and the water trickles from the shallow basin a quite rapid stream through the grass to lose itself in a large creek. The current is so rapid that, although the little bays and indentations along the margins are choked with masses of *Vaucheria* and filamentous floating Algæ, I had supposed it to be hardly adapted to infusorial life, and consequently never examined it, with infusoria as the object, until recently. I then obtained in considerable abundance a creature whose method of taking its favorite food is so curious and, indeed, so admirable an adaptation of means to ends, that it seems to merit a short paper to itself.

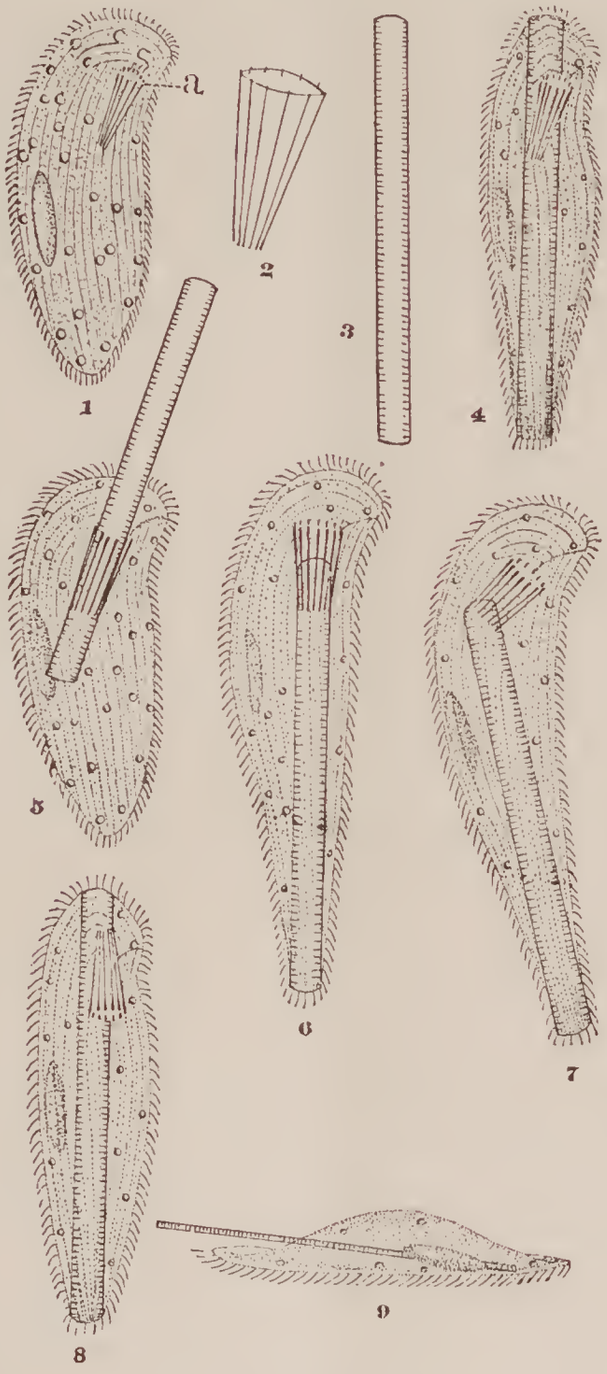
The infusorian is an undescribed species of *Chilodon*, a member of that order in which the locomotive cilia are confined to the lower surface, the oral aperture opening on the same part at a considerable distance back of the frontal margin. The animalcule is shown enlarged in figure 1, *a* being the position of the mouth. The latter is followed internally by a very peculiar obconical pharynx formed of delicate but rigid rods. A much enlarged diagram of this structure is represented in figure 2. It is a kind of cage or basket open at both ends, the longitudinally disposed rods being attached to the creature's body only at their external or oral extremity, the distal or internal ends being entirely free within the endoflasm, the animalcule having the power to slightly expand this deepest portion of the pharynx. Judging from the infusorian's actions under certain

circumstances, the constituent rods are connected by an elastic membrane, but its presence I have not been able to demonstrate.

In the same gathering with this *Chilodon* were innumerable specimens of a diatom which I take to be a species of *Nitzschia*, the frustules being extremely long and linear, their length much exceeding that of the normal animalcule, yet the latter was feeding voraciously upon these plants, the water apparently swarming with Chilodons in the condition shown in figure 4, where the two extremities of the animalcule seem extended to the point of rupture by the pressure of the engulfed diatom. (A diagram of a frustule is exhibited by figure 3.) If a single infusorian only had been found in this condition I would probably have passed it with the thought that the occurrence was accidental, but when such accidents occurred by the hundred they became something more, and demanded investigation. It was very evident that the animalcules were feeding on these long diatoms, and it at once became an interesting problem to ascertain how the feeding process was accomplished, how an animal apparently three inches long could swallow an absolutely inflexible diatom apparently four inches long. I exercised my guessing powers, and supposed that the frustule was passed through the oral aperture until the tail end of the animalcule was sufficiently protruded to allow the diatom to glide out of the pharynx, slip forward through the endoplasm, and thus relieve the posterior pressure. But I was almost entirely wrong. The animalcule's way was much better than mine. It was laughable, too, to see that——; but this is the way it was done.

The end of the diatom is engaged within the aperture of the pharynx and passes rapidly through into the endoplasm, the body substance seeming to possess a suction power that draws the food into it with astonishing speed. The act is shown in figure 5, where the frustule is passing through the expanded pharynx. In figure 6 the diatom has pushed out the infusorian's tail to the limit of endurace, it would seem, but the other end is not yet free from the pharnyx, and the situation appears critical. At once the pharynx becomes obliquely tilted, as in figure 7, and the diatom appears to have actually penetrated the animal-

cule's substance and to be projecting posteriorly into the water beyond, but the appearance is illusory; the cuticular surface still surrounds the end of the frustule as a delicate film, and



he cilia continue in motion. At this stage I expected to see the diatom slip through the longitudinal interspaces in the rod—fascicle, but it did not; and this leads me to suppose that an invisible elastic membrane connects the rod-like elements.

This slight obliquity of the pharnyx somewhat increased the pressure on the posterior cuticular surface and may have facilitated the next move, which was an unexpected one and the key to the problem. The entire pharynx suddenly rotated around the oral aperture as a center, turning itself upside down, the diatom slipping out, darting forward as it did so and pro-

truding the cuticle at both ends of the animalcule's body, as shown in figure 8, where the inverted pharngeal rod-fascicle is also exhibited. The pharnyx is often forced to remain in this inverted position until the endochrome within the frustule is digested out, and the empty plant is extruded from the body, as the diatom once in this tight place is not moved until the digestive processes are completed, the pharynx, in the meantime, having no room to rotate back to its normal position. But so voracious is the creature that it often attempts to engulf additional frustules even while the pharynx is upside down, an attempt which is of course always abortive. When there is enough space before the extrusion of the empty frustule, always after its expulsion, the return movement of pharyngeal rotation is voluntary. On account of the creatue's voraciousness I have elsewhere named it *Chilodon vorax*.

The anal aperture is on the animalcule's dorsal surface, as shown in figure 9, where it has been represented considerably out of its proper position. It should be much lower and nearer the posterior extremity. Indeed, the figures are, at best, little more than diagrams.

AMERICAN SOCIETY OF MICROSCOPISTS.

D. S. KELLICOTT, SECRETARY.

IT has been determined by the Executive Committee of the American Society of Microscopists that the next annual meeting shall be held at Chautauqua, N. Y., commencing Aug. 10th and continuing at least four days.

The place and time are regarded as favorable for a large and profitable annual reunion. Chautauqua is delightfully situated, readily accessible, the rates of travel to the resort are greatly reduced, besides the thousands of people residing there are in pursuit of recreation and knowledge.

The week of meeting is near the end of the usual summer vacation and one week before the meeting of the American Association for the Advancement of Science at Buffalo.

As early as June 1 circulars of information concerning the general sessions, the working session, railway fares, board, etc., will be sent to all members and others desiring them.

Letters addressed to the secretary will be promptly and cheerfully answered.

AMERICAN SOCIETY OF MICROSCOPISTS.—NINTH ANNUAL MEETING.

T. J. BURRILL, PRESIDENT.

THE ninth annual meeting of the society will be held at Chautauqua, N. Y., commencing August 10th, 1886, and is to continue four days. This is the week preceding the meeting of the American Association for the Advancement of Science, at Buffalo, N. Y., and is therefore very convenient in time and place for those who wish to attend both conventions.

The attractions of Chautauqua as a delightful place of summer resort, as well as for the high order of the varied intellectual exercises occurring there; the activity and enterprise of the officers whose invitation we accept; the interest in educational and scientific matters manifested by the people who annually gather there in August; the low railroad rates always made from all parts of the country to Chautauqua; the inexpensiveness of the enjoyable accommodations, are so many guarantees of the success of our meeting. We confidently expect a very large attendance of our old members, and as confidently look forward to a considerable accession to our ranks. Indeed, everything now known indicates the largest attendance ever held by our society.

We hope the facts may justify these reasonable expectations. Let us make the meeting memorable for the number of registered names. Let every member arrange his affairs for attendance and besiege the secretary for blanks upon which to send in new names. We want all the working microscopists in the country to join with us and increase, while sharing, the advantages and benefits of the society. Try!

We must, however, do more than meet. Friendly greetings and social enjoyments are recognized and favored at all our assemblies; but business is placed before pleasure. What is wanted more than all and above all, is worthy contributions to our Proceedings.

The published volumes of past meetings have gained for our organization an established reputation for excellent work. We can and ought to make the next volume still better. To this end, or rather for our common interest in science and art, each member is urgently requested to bring to the meeting the

choicest products of his investigations. Be sure to prepare something, and let this something be the best that circumstances permit.

The promises for the "working session," under the inspiring management of Mr. Griffith, are abundantly satisfactory. We shall certainly have a very important exhibition of methods and processes, and this alone will, to many, repay the trouble and expense of the journey. The requests of the director are cordially commended to your respectful consideration.

The Soiree will naturally attract a large attendance. It is hoped that members generally will aid in the exhibits, as they have kindly done in the past. Promptness of replies to the inquiries of the committee is very desirable.

Members are once more warmly urged to have manuscript ready when read for the printer. The publication of the Proceedings ought not to be delayed one day on account of needed revision of text or preparation of drawings.

Titles and abstracts of papers should be sent as soon as practicable to the Secretary, Prof. D. S. Kellicott, Ph. D., 119 Fourteenth Street, Buffalo, N. Y. Send them now if possible. Some have already been received.

WORKING SESSION.

E. H. GRIFFITH, DIRECTOR OF WORKING SESSION.

THE Working Session of the American Society of Microscopists to be held at Chautauqua, N. Y., in August, will be of more than usual interest. An entire day or an afternoon and evening will be devoted to it, and during the session more may be learned in microscopical technology by seeing the methods of work of the large number of experts who promise to assist, than in a whole year by reading books and papers at home.

All microscopists who have so kindly given their time and their experience in the working session of previous meetings, and all other workers who can give instruction in any department of microscopy, are cordially invited to assist at Chautauqua, providing they will report what they are willing to do to E. H. Griffith, Fairport, N. Y., previous to July 1st. It is very desirable to have a quick response to this invitation. Practica

suggestions from microscopists in regard to the session will be gladly received. If time will permit an hour or more will be devoted to discussion on special methods, but no member will be expected to occupy more than five minutes, or to speak more than once without permission.

It will save much valuable time in giving explanations, and add greatly to the practical results of the day if as many of those who assist, as feel willing to do so, will procure for distribution printed descriptions of their methods of work, whether original or not. These descriptions will cost but a trifle, and they will aid the Secretary also in preparing the Proceedings for the printer. Will you not please do this for the benefit of those who desire information, and for the success of the session, and will you not have it done at once?

Prof. D. S. Kellicott, our Secretary, has secured a valuable contribution of slides from the members of our Society, which are to be the nucleus of a permanent collection for the Society's use. In addition to this, the Director of the Working Session solicits from all microscopists, and from others who are willing to contribute slides, mounting materials, apparatus, books, papers, etc., which shall be known as the Working Session Collection, and which shall be in the care of a custodian selected by vote of the Society. *Will you please respond at once to this invitation and send to Fairport, N. Y.?* Our honored Ex-President, Prof. H. L. Smith, suggests that at some future time, not far distant, the American Society of Microscopists may select some city where it shall meet at stated periods of five or ten years in rooms fitted up expressly for it, and where all of its property may be safely stored.

At this early date it is impossible to give a programme of the next Working Session, but several new features will be added, and many who have not been with us before promise their assistance. It gives me great pleasure to write that Hon. J. D. Cox, of Cincinnati, Ohio, has promised to take entire charge of photography in its application to microscopical research.

Prof. D. S. Kellicott, of Buffalo, N. Y., assisted by Prof. T. B. Stowell, of Cortland, N. Y., will have charge of a dredging expedition on Lake Chautauqua.

Prof. Allen Y. Moore, M. D., of Cleveland, Ohio, and Mr. W. C. J. Hall, of Jamestown, N. Y., are the Assistant Directors in the Working Session, and much may be expected from their experience in microscopy.

A more delightful place for our meeting than Chautauqua, could not well be found. It is free from the noise and confusion the dust and the smoke of great cities, and being on the shore of a beautiful lake, it is a resort where the weary seek for rest. It has good hotel and cottage accommodations at moderate rates, and all railroads give greatly reduced fares to and from Chautauqua.

May the hearty good will which has been among the members of the A. S. M. at all our meetings continue during all future conventions.

SECTIONS OF TEETH.

DR. W. C. BRITTAN, DETROIT, MICHIGAN.

VERY beautiful sections of the jaws of small animals with the teeth in situ may be made in the following way: The jaws of a well injected animal are placed for a few days in 50 per cent. alcohol, then into absolute alcohol for about two weeks, then with a fine sharp file cut away the bone from both sides of the jaw where the section is desired until, by holding to the light, the pulps of the teeth are visible, carefully keeping the piece and the file wet with alcohol during the operation. Thoroughly wash the piece with a soft brush in alcohol and place in clove oil for a few hours, or until clear. Then transfer to a very thin solution of balsam in benzole, gradually thickening the solution from day to day by adding pure balsam until the tissues are thoroughly permeated. This is an important part of the process and should not be hurried. Now place the piece in some shallow dish and add pure balsam enough to cover it and evaporate to hardness, being careful not to raise the heat above 110° F. When the balsam is hard the section may be worked down to suit. The balsam will hold the soft parts in position while this is being done; use water as a lubricant for this part of the work. The section made to suit, dissolve out the balsam with benzole, place in absolute alcohol for a day,

clear again in clove oil and mount. Sections made in this way are necessarily somewhat thick for the reason that the different parts which are desired to show in the section seldom lie in the same plane, consequently they are best mounted in a cell ground into the slide which allows the cover-glass to be brought down close and making a handsome job when finished. The method may seem somewhat tedious and certainly requires some patience but the results more than repay for the trouble.

NOTE.—Dammar will be found the best medium for mounting.

SELECTIONS FROM THE PRESIDENTIAL ADDRESS OF DR. DALLINGER, GIVEN BEFORE THE ROYAL MICROSCOPICAL SOCIETY.

C. H. STOWELL.

"SO wide and diversified has the field of research become, that it is to experts chiefly that we must look for criticism, interpretation, and suggestion of the most lasting value."

"Exact and exhaustive research in the remotest fields must be encouraged and fostered."

"The larger proportion of the septic organisms whose life-history we have thoroughly studied, were distinctly nucleated bodies. I know of no clear reason for concluding that they are either vegetal or animal. They possess some of the characteristics of both, and certainly they represent the lowest organization of either great line of organic life."

In the act of self division "it can now be shown by the employment of the new lenses of greater aperture, that it is the nucleus that is first, and very profoundly, affected."

"In a thoroughly healthy, vigorous field of *Tetramitus rostratus* from ten to twelve fissions will be effected in one hour if we steadily follow one of the two divided organisms successively in continuous divisions. This will continue for hours without cessation, causing a prodigious increase in the organism."

"One thing appears clear: the nucleus is the centre of all the higher activities in these organisms. The germ itself appears but an undeveloped nucleus."

"It is by a complex and a beautiful series of delicate activities in the nucleus that the wonderful act of fission is initiated and in all probability carried to the end."

"In thus coming closer to the delicate phenomena of nuclear activity, we of course come no nearer to the solution of what life *is*. That is no part in the question. But to come any distance nearer to a knowledge of how the most living part of the minutest organisms in nature acts in detail, has for me, and for most biologists, an increasing fascination."

The above brief extracts convey but a slight idea of this admirable address on The Cell Nucleus. We clip the following from an exchange:—

"The last number of the Journal of the Royal Microscopical society contains the annual address of the President of the society, Rev. W. N. Dallinger, LL. D., and also an excellent portrait of that gentleman. Few men have accomplished so much in the more difficult lines of microscopical investigation as Dr. Dallinger, or are better fitted to hold the honorable place he holds at the head of English working microscopists. The address deals mainly with his own researches on the cell nucleus as he has observed its development and changes in septic organisms. The investigations which he details are of the most difficult character, and require the very highest and best powers of the microscope, as well as the most consummate skill in its use. These and the investigations of the nucleus, in which recent German microscopical literature is so fruitful, clearly prove that the nucleus is the most living part of the organism, that it is preeminently in this part of the cell that the life resides. In investigating it the scientist is peering into the very citadel of life, and although he may be getting no nearer to the solution of the problem of what life is, the study is nevertheless one which possesses extreme fascination."

THE FAKIR AND HIS LITTLE FAKES.

A MAN is passing around, charging $5 for the following: Cutting, boring and fileing glass. For cutting, with a few sweeps of a file make a nick in the top side at the edge of the glass to be cut. For plate glass use a half inch round iron two

or three feet long, with its ends cut squarely off, heat one end of the iron and with it reach across the glass to near the nick made by the file, hold the hot iron at an angle of about ten degrees on the glass. Soon a crack will run from the nick to the hot iron, and will follow the iron as it is slowly drawn along. The glass can be cut straight, curved or at right angles.

For fileing, boring, etc., use one ounce spirits of turpentine, one ounce camphor (the alcoholic solution), and two drachms of ether; wet the file with the above. To bore a hole in a bottle or plate of glass dip the end of a three cornered file in the solution and with it bore through. It is astonishing to see how quickly and nicely this can be done.

EDITORIAL NOTES.

THE BACILLUS OF HYDROPHOBIA.—Strange as it may appear, it is a fact that there are intelligent beings who do not believe in the value of vaccination. They state that it either does not prevent smallpox, or, if preventing it, the dangers of using humanized virus are so great that it should be discontinued. These persons regard Jenner, therefore, as one who brought endless misfortune to the human race. So to-day, we find, in a prominent journal before us, an article on the work of Pasteur by one who, in all probability, belongs to the class mentioned above. The work of this eminent man is characterized as founded "on untrustworthy experiments and unsound reasoning." The writer says that the so-called results of all these researches deserve to be rejected and condemned "in the common interests of humanity as well as science." The vigorous and decidedly unfair tone of the article inclines to the belief that the author is entirely unacquainted with the brilliant results obtained by this indefatigable worker. When Pasteur first made known to the world the results of his researches, all parties were only too ready to pay homage to the genius which had given to science such a discovery. But how changed is the scene. In the place of enthusiasm there is the closest and in some instances the bitterest criticisms. The latter all honest workers pass over in silent contempt, while Pasteur himself invites the former, and

with a frankness that is surprising tells his methods to competent co-workers and asks their aid. It is gratifying to remember that nearly every scientific discovery has had to force its way in the face of the bitterest opposition. In the case of Pasteur there are unusual difficulties to overcome and it is evident that nothing less than an overwhelming mass of clinical statistics will ever convince both the profession and the laity of the value of his brilliant discovery. Certainly such an eminent man as Dr. Valentine Mott is not likely to be carried away by any craze. He just returns to us from Paris after careful study of the hydrophobia treatment, very sanguine in his belief of its efficacy. So firm is this belief that he brought with him a rabbit, inoculated by Pasteur, to be used for further propagation of the virus. These researches, coupled with those mentioned in our April number pertaining to the cure and prevention of phthisis, tend to confirm us in the belief that the future has in store for us a new era in the practice of medicine. The principal study will be not how to cure, but how to prevent disease. As honorable as the profession of medicine may be at the present time, this change will make it seven-fold more noble and will, then, indeed, make each physician a benefactor of his race.

THE OVERCROWDING OF THE MEDICAL PROFESSION.—If the principal business of the medical man is to study the cause of disease and apply the prophylactic remedy, it must follow, says the reader, that there will be no work for such a vast army of annual recruits as furnished by our medical colleges. Already there is relatively a greater increase in the number of graduates in medicine than of the population. These two considerations make us fear that a severe struggle for existence must be the lot of the average physician of the future. If naturally endowed with unusual abilities, or if possessed of sufficient wealth to enable him to continue his studies over a term of years and still have an income left to aid in getting a start in life, he will stand a fair chance to gain a high position with its accompanying recompense. But for all others, one of two things remains, they must drop out by the wayside or be content with a very moderate subsistence. About 3,750 medical students graduated in 1885, and this, too, when in the United States there is one physician to less than six hundred inhabitants, a far greater

proportion than is found in any other country on the globe. What is the remedy for these threatening disasters? Stricter requirements from our medical colleges. We do not mean by this, the rejection of a larger number of those who apply for graduation at the close of their college life, but the rejection of a much larger number of those who apply for admission. We do not mean the former because, first, a full course of instruction, in every medical college, should consist of at least three years, with from seven to nine months' study each year; second, a person who is capable of passing the entrance examinations—severe as these should be—should also be capable of acquiring in this term of study sufficient knowledge to enable him to pass a most rigid final examination. The trouble is not in the large number of our graduating classes, but rather in the large number of the classes just admitted. This preliminary examination should be not far, if any, below that required to enter a first-grade literary college for the degree of bachelor of arts. In other words it should embrace such subjects as English language, including the grammatical and rhetorical analysis of selections, and the writing and correcting of essays; Geography; Mathematics, arithmetic, algebra, geometry; Latin, at least an amount equivalent to one year's work at school; Natural philosophy; Botany. In this way only can the profession be relieved of a host of hungry incompetents whose only claim for recognition is their possession of a degree. A class of students admitted on substantially such terms as given above will take in and assimilate more knowledge in three years than the average unprepared student could do in nearly double that time. The result is inevitable. One-half of the present number of applicants would seek their more congenial spheres, and would make honorable citizens as farmers and mechanics; the remainder would, by their fitness, demand a higher grade of work on the part of the instructor, and thus teacher and pupil be mutually profited, only in the end to result in the greatest profit to the public at large. Each graduate then, by his college training, will be eminently fitted to scientifically investigate disease, to ascertain its cause, and to prevent its development. In that day the doctor will be not only a physician but also a scientist and a philanthropist.

A SEVEN YEARS' REMEDY.—Just here we are reminded of the Medical school of the Imperial University of Japan. This school, "which numbers its centuries by two figures," requires four years of medical study, with three years of preparatory training; or in all, seven years of college work. And yet last year there were nine hundred and seventy-two students in attendance.

SLIDE OF ARRANGED DIATOMS.—The Junior Editor is in receipt of another slide of these beautifully arranged diatoms, as prepared by Mr. Rinnböck, of Wein, Austria. We are very sorry to read in his last letter that his physician has ordered him to do no microscopical work for a whole year, and he then adds, "but I fear that it is forever." He says he has just sent to the San Francisco Microscopical Society the most difficult slide of arranged diatoms he ever made. All our readers will hope that the health of this eminent man will be fully restored, and even he, himself, most happily surprised.

TOOTH SECTIONS.—We are in receipt of two slides from Dr. W. C. Brittan, of Detroit, that are marvels of beauty. One represents the injected pulp of an adult tooth. The anastomosing of the vessels, their vast number, and their beautiful arrangement, all excel any diagrammatic representation we have ever seen. The other slide represents the longitudinal section of a deciduous molar, with the germ of the second tooth. The preparation is injected and is from a dog two weeks old.

TAIL OF MOUSE.—Dr. J. K. Stockwell, of Oswego, sends us this slide. By some decalcifying process the bones were softened so that complete transverse sections were made. The stainings employed differentiate the various structures to an unusual degree. The ossifying of the cartilage is finely shown. This is also a beautiful as well as an instructive slide.

DIATOMS.—W. H. Curtis, of Haverhill, Mass., sends us a slide of *pleurosigma*. The material is nicely cleaned and exquisitely mounted.

INJECTED LUNG.—This preparation from the Guinea pig was prepared by C. Blasdale, Jericho, N. Y., and is positive proof that he certainly succeeded in getting a fine injection.

MICRO-PHOTOGRAPH.—The "Stowell Microscopical Club," of Albion, Mich., sends us this photograph of their sixteen mem-

bers. This club is composed of students of Albion College. Not daring to include the two members of the faculty whose faces we recognize, we would venture to say of the remaining ladies and gentlemen, that they are "a fine looking lot of boys and girls, and, *inter nos*, *sub rosâ*, especially the girls."

SELECTIONS.

BACTERIAL PATHOLOGY.

With the conviction that a little humorous dessert will contribute to the digestion of the numerous therapeutic dishes served to our readers by the *Gazette*, we present to them some choice morsels picked from Dr. Nordau's interesting Parisian epistle to our Viennese contemporary, the *Wiener Med. Wochenschrift*, No. 8, 1886.

"The last of the valiant and dreaded enemies has surrendered. Stricker has hoisted the white flag and entered the camp of the microbio-pathologists with flying colors. He was one of those who had fought most bitterly and more persistently against the new faith, objection to which is at the present day only excusable in the man born blind, for he alone is not open to the *anti-oculos* demonstrations of the microscope, the test-tube, and the pure-culture. But lo! there is still one pagan knight who is not to be converted, not to be conquered. Boldly and proudly he upholds the banner of the humoral (or is humorous now the proper adjective?) pathology. Not he that fears the impinging phalanges of the bacilli, shrinks before the spirillæ pickets, or loses his sang-froid at the approach of swarming spirochetæ. This knight *sans peur et sans reproche* is Peter, Prof. Peter of the Faculty of Paris. Like Horatius Cocles, he fights alone against an army. Maybe, however, he only wishes to carry out Victor Hugo's heroic words: 'Et s'il n'en reste qu'un, je serai lui-là!'—And if but one is to remain, it shall be I. We all know of the reverend Pastor Knack, who bravely called Copernicus a liar, and defended the rotation of the sun around the earth. Knack's death was a hard blow to the humorous papers, still Peter is alive, that is some substitution. Peter's opening lecture of the last winter course, before the crowded auditorium, will

remain forever memorable in the annals of medicine. Though it was full of *chic* and Attic salt, it cannot be said to have been seasoned properly, for the carnival was not to commence for some months yet."

We regret that our valuable space cannot be more exhaustively devoted to the amusement of our readers; a brief abstract of some few passages of Peter's lecture, which, intending to ridicule Koch, Pasteur, and Lustgarten, the discoverer of the syphilis-bacilli, ridiculed actually Peter alone, is all we can give:

"The bacillus discovered by the 'Berliner Koch' (why not the Prussian Cook?), and about which so much fuss is made, has no diagnostic value, as it is found in tuberculosis, syphilis, leprosy, and even the preputial smegma of healthy persons. True, there are some trivial differences in these bacilli as to form and coloring matters, but what does that signify, as bacteriologists admit themselves that morphological differences play no essential *rôle* in the determination of the nature of a bacillus."

"What deplorable therapeutic results are there not ensuing from the views of the microbio-pathologists! They separate externally the tubercular subjects, and internally they give them alleged bacillus-killing drugs, such as creasote, carbolic acid, and heaven knows what other dirt. ('Et on ne sait quelles saletés.') I shall nôt cease to fight with word and letter against this mental aberration which confuses the brain of profession and laity alike."

No wonder that the impulsive youth from the quartier Latin brought a thundering ovation to their enlightened and courageous teacher, who had thus disproven and conquered definitely the "Berliner Koch."

In cinclusion we have yet to allude to the nonsensical tribute paid to Peter by the *Evènement* (a Paris newspaper), which brought the picture of Peter in the *rôle* of George the Dragon-killer, and proclaimed at the termination of an article exornated with the usual Gallic *élan* and prestige, "And so has the common sense of the Frenchman again annihilated a chimerical product of German brains."—*Therapeutic Gazette.*

SURPRISING WORKS OF ART.

Dr. Power says, he saw a golden chain at Tredescant's, of three hundred links, not more than an inch in length, fastened to, and pulled away by a flea. And I myself have seen very lately, near Durham yard in the Strand, and have examined with my microscope, a chaise, (made by one Mr. Boverick, a watch-maker) having four wheels, with all the proper apparatus belonging to them, turning readily on their axles: together with a man sitting in the chaise; all formed of ivory, and drawn along by a flea without any seeming difficulty. I weighed also at the same time and place, a brass chain made by the same hand, about two inches long, containing two hundred links, with a hook at one end, and a padlock and a key at the other; and found it less than the third part of a grain.

We are told, that one, Oswald Nerlinger made a cup of a pepper-corn, which held twelve hundred other little cups, all turned in ivory, each of them being gilt on the edges, and standing upon a foot: and that, so far from being crowded or wanting room, the pepper-corn could have held four hundred more.

I have seen since my writing the above, (made by the same artist) a quadrille table with a drawer in it, an eating-table, a side board table, a looking glass, twelve chairs with skeleton backs, two dozen plates, six dishes, a dozen knives, and as many forks, twelve spoons, two salts, a frame and castors, together with a gentleman, lady, and footman, all contained in a cherry-stone: and not filling much more than half of it.

These are some of the nicest, most curious and surprising works of art; but let us examine any of them with a good microscope, and we shall immediately be convinced, that the utmost power of art is only a concealment of deformity, an imposition upon our want of sight; and that our admiration of it arises from our ignorance of what it really is.

This valuable discoverer of truth will prove the most boasted performances of art to be as ill-shaped, rugged, and uneven, as if they were hewn with an axe, or struck out with a mallet and chisel. It will show bungling, inequality, and

imperfection in every part, and that the whole is disproportionate and monstrous. Our finest miniature paintings appear before this instrument as mere daubings, plastered on with a trowel, and entirely void of beauty, either in the drawing or the coloring. Our most shining varnishes, our smoothest polishings will be found to be mere roughness, full of gaps and flaws.

Thus sink the *works of art* when we become enabled to see what they really are!—But on the contrary, the nearer we examine, the plainer we distinguish, the more we can discover of the *works of nature*, even in the least and meanest of her productions, the more sensible we must be made of the wisdom, power and greatness of their author.—Let us apply the microscope where we will, nothing is to be found but beauty and perfection. View we the numberless species of insects that swim, creep, or fly around us; what proportion, exactness, uniformity and symmetry shall we perceive in all their organs! what a profusion of coloring! azure, green, and vermilion, gold, silver, pearls, rubies and diamonds, fringe and embroidery on their bodies, wings, heads, and every other part! How rich the glow! how high the finishing! how inimitable the polish we everywhere behold!—Search we yet farther, and examine the *animalcules*, many sorts whereof it would be impossible for any human eye unassisted to discern; those breathing atoms, so small they are almost all workmanship! In them too we shall discover the same organs of body, multiplicity of parts, variety of motions, diversity of figures, and particular ways of living as in the larger animals.—How amazingly curious must the internal structure of these creatures be! The heart, the stomach, the entrails, and the brain! How minute and fine the bones, joints, muscles and tendons! How exquisitely delicate beyond all conception the arteries, veins, and nerves! What multitudes of vessels and circulations must be contained within this narrow compass! And yet, all have sufficient room to perform their different offices, and neither impede nor interfere with one another.

The same order, regularity and beauty will appear likewise among vegetables if brought to examination. Every stalk, bud, flower, or seed, displays a figure, a proportion, a

harmony beyond the reach of art. There's not a weed, not a moss, whose every leaf does not show a multiplicity of vessels and pores disposed most curiously for the conveyance of juices to support and nourish it, and which is not adorned with innumerable graces to embellish it.

The most perfect works of art betray a meanness, a poverty, and inability in the workman; but those of nature plainly prove the hand that formed them was absolute master of the materials it wrought upon, and had tools exactly suitable to its design. Every hair, feather, or scale, even of the meanest insect, appears rounded, polished, and finished to the highest pitch; and shows the abundant riches, munificence, and skill of its Maker.

But some may possibly enquire, to what purpose Providence has bestowed such an expense of beauty on creatures so insignificant: and then cry out, what is all this to us?—My reply is, that the beauty and elegance which adorn them, are evident and convincing proofs of their not being so insignificant as we presumptuously suppose they are: for, such beauty must be given them, either for their own sake, that they themselves may be delighted with it; or else for ours, that we may observe, in them, the amazing power and goodness of the Creator. If the former be the case, we must allow them to be of consequence in the account of their Maker, and therefore deserving our regard; and if the latter, it is really our duty to take notice of and admire them. But for whatever reason God has been pleased to bestow existence on them, and to clothe them with beauty, what he has judged worthy himself to create, is not, surely, below us to examine and consider. The hand that formed the whale, the elephant, and the lion, has likewise made the louse, the gnat and the flea.—*From Henry Baker, written in 1743.*

FINE WIRE.—Mr. H. T. Read says he has made some wire so fine that it cannot be seen with the naked eye, although it can be felt. A platinum wire is made the core of a silver tube and then drawn out with the silver to the thickness of the original platinum wire. This is in turn made the core of another silver tube and again rolled out, and, finally, the silver is dissolved off with nitric acid. The wire is to be used as a substitute for spider-webs.

CAUTIONS IN VIEWING OBJECTS.

Beware of determining and declaring your opinion suddenly on any object; for imagination often gets the start of judgment, and makes people believe they see things, which better observations will convince them could not possibly be seen: therefore assert nothing till after repeated experiments and examinations in all lights and in all positions.

When you employ the microscope, shake off all prejudice, nor harbor any favorite opinions; for, if you do, 'tis not unlikely fancy will betray you into error, and make you think you see what you would wish to see.

Remember that truth alone is the matter you are in search after; and if you have been mistaken, let not vanity seduce you to persist in your mistake.

Pass no judgment upon things over-extended by force, or contracted by dryness, or in any manner out of their natural state, without making suitable allowances.

There is no advantage in examining any object with a greater magnifier than what shows the same distinctly; and therefore, if you can see it well with the third or fourth glass, never use the first or second; for the less a glass magnifies, the better light you'll have, the easier you can manage the object, and the clearer it will appear.

It is much to be doubted, whether the true colors of objects are to be judged of, when seen through the greatest magnifiers: for as the pores and interstices of an object must be enlarged according to the magnifying power of the glass made use of, and the component particles of matter must by the same means appear seperated many thousands of times farther asunder than they do to the naked eye, their reflections of the rays of light will probably be different, and exhibit different colors. And, indeed, the variety of coloring some objects appear dressed in, may serve as a proof of this.

The motions of living creatures themselves, or of the fluids contained within them, as seen through the microscope, are likewise not to be determined without due consideration: for as the moving body and the space wherein it moves are magnified, the motion must probably be so too. And therefore, that rapidity, wherewith the blood seems to pass along through the

vessels of small animals, must be judged of accordingly. Suppose, for instance, a horse and a mouse move their limbs exactly at the same moment of time: if the horse runs a mile while the mouse runs fifty yards (tho' the number of steps are in both the same) we shall readily, I believe, allow the horse's motion to be the swiftest. The motion of a mite viewed through a microscope, or seen by the naked eye, is, perhaps, not much less different.

Some people have made false pretences and ridiculous boasts, of seeing, by their glasses, the atoms of Epicurus, the subtile matter of Des Cartes, the effluvia of bodies, the emanations from the stars, and other such like impossibilities: but let no ingenious and honest observer give credit to these romantic stories, or misspend his time, and bewilder his brains, in following such idle imaginations, when there lies before him an infinity of real objects, that may be examined with ease, profit, and delight.—*From Henry Baker, written in 1743.*

OF EELS IN PASTE.

Whoever is desirous to be furnished with *minute eels* always ready for the microscope, needs only boil together a little flour and water, and make such paste thereof as book-binders commonly use; or it may be bought of them. It should neither be very stiff, nor very watery, but of a moderate consistence. Expose it to the air in an open vessel, and prevent its hardening or becoming mouldy on the surface, by beating it well together when you find any tendency that way; for if it grows hard or mouldy, your expectation will be disappointed. After some days it will turn sour, and then if examined attentively, you'll discern multitudes of exceedingly small, long, slender, wriggling *animalcules*, which grow larger daily, till you'll be able to see them with the naked eye.

To promote their coming forward, pour every now and then a drop of vinegar on your paste: and after they are once produced you may keep them all the year, by putting to them sometimes a little vinegar or water, if the paste becomes too dry, and sometime a little supply of other sour paste; taking care continually to preserve the surface in a right condition,

which will easily be done when it is well stocked with these *animalcules:* the continual motion of them preventing any mouldiness thereon.

A water-glass, or some other glass vessel, is the most convenient to keep your paste in; for by holding it up against the light, you'll oftentimes perceive the *eels* wriggling themselves above the surface of the paste upon the sides of the glass, and may be able to take several of them with a pen or hair pencil, much more disengaged from the paste, and consequently fitter for view, than if you are obliged to examine the paste itself in order to find them in it.

Apply them to your microscope upon a single talc or isinglass, after having first put on it a very small spot of water for them to swim about in. The thicker your paste is, and the more they are enveloped in it, the greater proportion of water will be requisite to dilute it, that they may disentangle themselves, and be rendered distinctly visible.

They are very entertaining objects, examined by any kind of a microscope, but particularly the solar one, by which I have magnified them sometimes to an inch and a half, or two inches in diameter, with a length proportionable, and have found them answer exactly the appearance of such sized eels. The internal motion of their bowels may very plainly be distinguished, and when the water is dryed almost away, and they are near expiring, their mouths may be seen opening to a considerable width.—*From Henry Baker, written in 1743.*

A NEW MICROSCOPE SLIDE.—Those who delight in looking at the coursing of the blood through the web of a frog's foot, or the motion of the sap as seen in Vallisneria, will be pleased with the spectacle of the flow of oil towards the flame of a burning lamp. To see this interesting phenomenon it is only necessary to raise the burner partly out of the lamp, then hold it steadily, close enough to the microscope, which ought to bo turned horizontally, and use a 1 in. or lesser power objective, when the current of fluid will be observed writhing and struggling amongst and through the interstices of the cotton wick. The oil may be colored if thought desirable.—*English Mechanic.*

EXCHANGES.

FOR EXCHANGE.—Fiddian Microscopic Illuminator, brass injecting syringe, Dr. Seilers section knife, warm stage with thermometer and gas chamber, "Archiv für Microscopische Anatomie," bound; in exchange for first class Polariscope, collection of thin, mounted rock sections or collection of minerals—would also exchange for books, geological reports, or books on Mineralogy, Lithology and Geology. HENRY FROEHLING, 17 South 12th Street, Richmond, Va.

FOR EXCHANGE.—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially esired. ROBT. W. WOOD, JR., Revere St., Jamaica Plain, Mass.

FOR EXCHANGE.—Mounted sections of injected lung of guinea pig.
CHAS. BLASDALE Jericho, Queens Co., N. Y.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

FOR EXCHANGE—One Fiddian Microscopic Illuminator, one Brass injecting Syringe with four pipes and stop cock, one Microtome (Brass) Rivet, improved, with knife, one Dr. Seilers Section Knife and Carrier, one warm Stage with Thermometer and Gas Chamber in exchange for first class Polariscope with goniometer Eyepiece or collection of thin mounted Rock sections.
DR. HENRY FROEHLING, 17 South 12th street Richmond, Va.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W. WESTOVER, M. D., St. Joseph, Mo.

WANTED.—A copy of No. 1. Vol. IV., The Microscope; will give slides in exchange, or cash.
Very Truly, HENRY FROEHLING, Richmond, Va.

WANTED.—Unmounted material, any kind; foram-inifera and diatoms preferred; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

WANTED.—Good 1-4; spy glass; will exchange good objectives, including new Gundlach 4-10 of 80°. C. OUDERDONK, Rugby, Tenn.

WANTED.—Micrographic Dic'y, 4th ed. Will give Wales 1-10 immersion, 135°.
DR. ED. GRAY, Benecia, Cal.

FOR EXCHANGE—Cathcart's ether freezing microtome, complete. Would prefer an injecting syringe. A. B. AUBERT, Orono, Penobscot Co., Maine.

WANTED—No. 5 of Vol. 2, and No. 1 of Vol. 3. This journal. Who can supply?
D. HUMPHREY, Lawrence, Mass.

FOR EXCHANGE—A new mechanical finger for a copy of Beale or Carpenter; slide of grouped diatoms for French objective, ¼ in. focus. HAROLD PLOWE, 136 High St., Peoria, Ill.

FOR EXCHANGE OR SALE—Wood sections, mounted or unmounted. Also few mounts of water-washed diatoms. H. M. RICHARDS, Sadsburyville, Pa.

WANTED—Micro-dictionary, 1 in. objective, accessories, rare diatoms, etc., for rare and ordinary slides. Please exchange lists. R. E. WOOD, St. Helena, Napa Co., Cal.

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THE MICROSCOPE.

VOL. VI. ANN ARBOR, JULY, 1886. No. 7.

ORIGINAL COMMUNICATIONS.

MICROSCOPY IN MEDICINE.*

A. G. FIELD, M. D., DES MOINES, IOWA.

IF there is misfortune in our natural deficiencies of feeling, of hearing and of seeing, and if the progressive and arbitrary demands of modern medicine upon the special senses impress us with a sort of disagreeable consciousness of the fact, that misfortune has been met to a large extent by the supplemental aids incidentally supplied in the rapid advancement of the physical sciences. At the bedside and in his office, the modern physician employs these aids to a large extent, and more constantly than do those engaged in any other calling or profession. This is emphatically true in relation to the microscope. In normal and pathological histology, in diagnosis and prognosis, as well as in the etiology of disease, this adjunct to the sense of seeing is indispensable.

The microscope brings nearly every branch of medical science within the pale of rationality; and it renders the present an era of demonstration rather than of theory so that the student, as a rule, proceeds from the college to the field of practice with clear cut opinions upon the subjects of his work.

It would appear idle on an occasion like this, and before such an audience, to attempt a review of microscopy as a factor in the establishment of our present advanced knowledge of nearly every disease. It alone has disclosed the fascinating pictures of tissue structure and tissue change in health and in growth, and of tissue change in degeneration and disease; and it has furnished everywhere suggestions to improve our thera-

*Read before the annual meeting of the Iowa State Medical Society, held in Des Moines May 18–21, 1886.

peutics, as well as hygiene. Our text-books are our witnesses. But accepting the germ theory of disease as the true one, we have presented a subject for microscopy far beyond the subjects of tissue structure and tissue change in point of abstruceness and value as well, which has been but little more than fairly entered. There is here among the subtle agents of contagion and infection an unlimited domain where the microscope must be the chief or only guide. While much of great value has already been brought to the surface, it is impossible to predict the future importance of medical microscopy with objectives of the more refractive glass recently brought out, and the improved methods of culture, isolation and inoculation. It may be profitable therefore on such an occasion as this to open for discussion some questions pertaining to manner of inquiry for facts which appear to lie beyond the boundaries of our present knowledge; for well considered and systematized preliminaries are even more essential in these undertakings than in any others. The biological nature, habitat and habits of any given poison should be studied as far as possible from a recognition of all the general conditions or circumstances or phenomena, attending its manifestations, and these formulated to be used as guides in further studies. As bearing upon the subject, I venture to offer two propositions:

First—That a disease poison, if originating or propagating within the body, is most abundant, mature and virulent, in connection with the tissues, secretions, solids or fluids, which furnish a natural pabulum, and hence in this connection it will be most susceptable of discovery.

Second—That the study of any given disease poison as far as possible from the general conditions or circumstances attending its action, furnishes valuable suggestions for proceedures, and in some measure points to the biological nature, habitat, habits and physical attributes of such poison.

If these propositions have been well considered, it would appear to be pertinent to inquire whether the recent studies relating to the infections of *rabies* and of *cholera* have been wisely directed by what has been regarded as settled facts deduced from general observations.

In the veterinary school of Berlin more than fifty years

ago, experiments were made with reference to the poison of rabies. It was then satisfactorily demonstrated that the poison was not volatile, that its vehicle is the saliva, and papulum the salivary glands of rabid animals, and that it does not exist in the nervous pulp, which in a putrid condition is now being employed by Pasteur and his followers for prophylactic inoculations. These experiments and observations were repeated and the facts verified by such authorities as Trolliett, Berschet and Majendie. Of fifty-nine dogs inoculated with saliva fourteen became rabid. It was also established by statistics that but one person in eighteen or twenty bitten by rabid animals became infected with the disease, and it has long been known that hydrophobia, or water dread, is not constant in rabies, and that it may be concomitant in the morbid conditions including blood poison diseases. Without extending references, the above is sufficient to raise a doubt as to whether Pasteur has found or is using the poison of rabies in the putrid brain infusion with which he is operating.

But that Pasteur is operating with an infectious poison there can be no doubt, and a brief reference to one of the forms of septicæmia from inoculation with putrid meat infusion may throw some light on the subject. From an extended series of experiments Dr. Sanderson names the following symptoms as characterizing septicæmia with inoculation with putrid meat infusion: "Dullness of the eyes, with increased conjunctival secretion, finally gluing the lids together." Pasteur, it would appear, regards this as almost pathognomonic of rabies. "At first the animal moved but little, was languid, had loss of appetite, weakness and slowness of respiration and circulation." These symptoms were succeeded by "restlessness, insane acts, muscular twitchings, spasms and death." These are the symptoms then to be expected in this form of septicæmia, and they are, substantially, what Pasteur claims to produce in modified form by his inoculations. There is a strong probability, therefore, that investigations pushed however far with Pasteur's inoculation fluid will not discover the real poison of rabies nor result in prophylaxis, unless from *similarity* rather than identity of poison, which claim, so far as I know, has not been set up. There is an equally strong probability, too, that the poison

does exist in greatest abundance, maturity and virulence in the saliva and salivary glands of rabid animals, and that these are the proper or more promising subjects for investigations by inoculation, cultivation and microscopy.

Much has been said and written for and against Koch's comma bacillus as the cause of cholera. All bacilli are vegetable in nature. They are flowerless plants, but devoid of chlorophyl; they do not subsist as most other plants do, by the decomposition of carbonic acid gas, but take oxygen direct from the atmosphere and the pabulum in which they live. Some of them are endowed with power of passive motion, but to none of them so far as I know, nor to their spores, have been attributed self-propelling powers for aerial navigation. Their transportation is accomplished by accident and by atmospherical currents. I submit the question as to whether the history of cholera invasion and spread accords with such agencies.

With a sort of home upon the Ganges, in the form of an almost perpetual endemic, it occasionally becomes in some sense migratory and epidemic in nearly all parts of the world. The lines of its ravages do not correspond to the varying currents of the atmosphere, nor to accidental forces. The history of these epidemics shows a movement from place to place with some regard to regular succession as to time, and to constancy as to direction, and with but secondary regard to prevailing winds or to geographical obstacles. Dr. Snow detailed the movements of one epidemic of this disease with perhaps as much faithfulness as any that has been published. Breaking out at Jessore, it proceeded to Calcutta, from where it radiated simultaneously in three distinct lines, one south-west to Madras, another south-east along the opposite coast of the Bay of Bengal, and a third north-west along the valley of the Ganges. These streams of pestilence, in their several directions, pursued the even tenor of their way, halting and again breaking out at irregular intervals at nearly every step, until they well-nigh enveloped the earth.

The same general facts will appear in tracing the course of some other epidemics of this disease, which any one can do at leisure.

Without taking further time, therefore, to review the general behavior of the poison during its migrations, we venture the prediction that when found to the satisfaction of all, as I believe it will be, the poison of cholera will prove to be possessed of self-propelling powers such as do not belong to any bacillus, but which harmonize with the animalculæ hypothesis. And since the English Commission, headed by Dr. Klein, has failed to identify the comma bacillus as the etiological agent of cholera, as claimed by Dr. Koch, it is at least presumable that more satisfactory results may be predicted when microscopy cultivation and inoculation shall be pushed with special reference to the animalcular theory.

As to other infections I may mention briefly that those of yellow fever, milk sickness and typhus fever are believed to be swallowed with the food, and hence reside in the atmosphere as well as in the alimentary tract—that those of measles, scarlet fever and whooping cough are thought to be inhaled and hence reside in the air passages as well as in the atmosphere, and that those of small-pox, diphtheria and erysipelas may be inoculated, and hence may be looked for in the blood.

When so much precision of manipulation and care is required as in the advanced microscopy employed in these studies, and where appearances are so liable to misrepresentation, it is fortunate that modern science has brought forth a ready means of verification in micro-photography. The rays of light are no respectors of persons nor of theories, and no delusions of sight nor intellect can pervert the faithful evidence of a photograph. Some of these I shall show by projection to-night, the subjects for the most part histological. In some instances the amplification is three thousand, and upon the canvas the images will be enlarged many more diameters.

WHAT MAKES VINEGAR SHARP?

Some people have imagined that the sharpness of vinegar is occasioned by the eels striking their pointed tails against the tongue and palate; but it is very certain that the sourest vinegar hath none of those eels, and that its pungency is entirely owing to the pointed figure of its salts, which float therein.—*Geo. Adams, 1747.*

STUDIES IN HISTOLOGY.

C. H. STOWELL.

METHODS OF EXAMINING.

MUCOUS TISSUE.

SMALL pieces of the umbilical cord of any mammalian fœtus are placed in Müller's fluid and afterwards in alcohol to complete the hardening. Very thin transverse sections are made, carefully stained, and examined in glycerine, or cleared and mounted in balsam. Thin sections may be studied to advantage by pencilling after staining, although better success will follow this method if only the fresh specimens be used, the thin sections having been made by aid of the freezing microtome.

Subcutaneous tissue may be removed from any young embryo, teased, stained and mounted in glycerine.

WHITE FIBROUS TISSUE.

A small piece of subcutaneous tissue is placed on a slide and moistened with the salt solution. Bundles of the fibrils are seen with their wavy appearance. A few elastic fibres may be seen here and there in the field. Acetic acid will cause this fibrous appearance to disappear and the tissue to look like a mass of jelly. The cells are seen without much difficulty in a specimen or intermuscular fascia. A small portion of this is excised with the scissors and by the aid of needles carefully spread out on a dry slide; the specimen is kept moist by occasionally breathing upon it. A drop of hæmatoxylin is now placed on a cover-glass which is inverted upon the specimen. A drop of acetic acid is placed at the edge of the cover and the cells now show to good advantage. Specimens of this tissue may be teased from a tendon while fresh or the tendon may be hardened in chromic acid and longitudinal and transverse sections examined.

For a permanent preparation, Cole recommends injecting the axilla of a recently killed kitten or young rat with a 1 per cent. solution of osmic acid. When the tissue has swollen, cut out the areolar tissue, place it on a slide, spread it out with needles and put on a drop of picrocarmine frequently renewed through 24 hours. Replace the staining with glycerine jelly and cover. Hematoxylin may take the place of the picrocar-

mine. The structure of tendon is best studied by following the nitrate of silver and gold methods. Immerse a thin section of

A B

A, Yellow Elastic Tissue. B, White Fibrous Tissue after adding acetic acid. x 400.

fresh tendon for a few minutes in a $\frac{1}{2}$ per cent. solution of nitrate of silver and follow the regular plan of silver staining. Use a $\frac{1}{2}$ per cent. solution of chloride of gold and treat after the usual method. Either of these stainings will show the corpuscular element.

A 10 per cent. solution of common salt will isolate the cells in young tendon tissues if allowed to act upon it for three or four days. Picrocarmine staining will give good results.

YELLOW ELASTIC TISSUE.

Small pieces from the ligamentum nuchæ of the ox are placed in a 10 per cent. solution of common salt for a few days in order that the fibres may be more easily teased apart. Thorough teasing with needles will cause the tissue to show to good advantage, and as the fibres will not take staining they can be mounted unstained in glycerine or glycerine jelly. The elastic net-work is well shown in the mesentery of the frog. A small portion is spread out on the slide and a drop of a dilute solution of acetic acid added. The white fibrils swell up and

become indistinct while the elastic net-work is brought clearly into view.

ADIPOSE TISSUE.

A small piece of ordinary fat tissue is placed on a slide and slightly teased in water with needles. Examined with a low power, the globular fat cells are seen together with larger and smaller droplets of free fat that have escaped from the ruptured globules.

Place some of the tissue in Müller's fluid and complete the hardening in alcohol. Make thin sections, stain with magenta, or hæmatoxylin, and mount in glycerine or after clearing, in balsam. If the tissue has been previously injected the peculiar net-work of capillaries will be well shown, as also their relation to the lobules and cells.

Take a small portion of the omentum of a cat, wash in water, and stain with a 1 per cent. solution of osmic acid; a deep black color is given to the fat. Examine the white fibrous tissue from the axilla after being injected with osmic acid as recommended above by Cole. To study the development of fat cells, some fresh subcutaneous tissue should be taken from the fœtus of any mammal, and treated with a 1 per cent. solution of osmic acid for 24 hours, after which it may be stained slightly with eosin. Numerous cells will be seen in which are only small droplets of fat stained a deep black, while others will be found in which no fat has yet appeared.

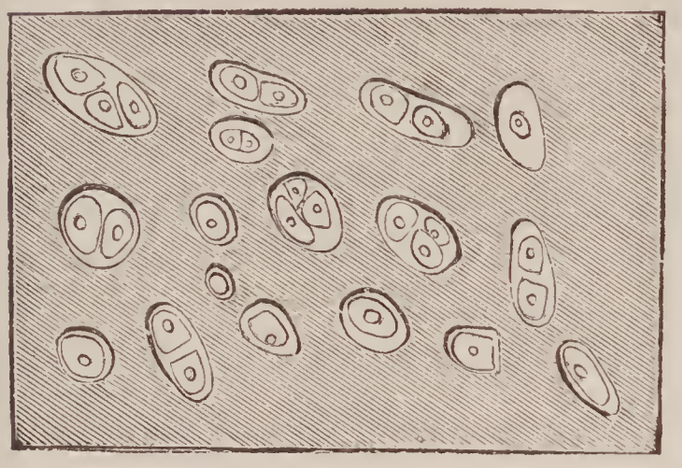
CARTILAGE.

For the study of hyaline cartilage nothing can excel the preparations obtained from the thin cartilage projecting from the sternum of a recently killed young newt. Any tissue covering the cartilage is easily removed and many times the specimen is thin enough for immediate examination. It is moistened with a drop of the normal saline solution and examined with a $\frac{1}{4}$ inch objective. Remove the salt solution and add a drop of a 5 per cent. solution of acetic acid. Now the nuclei become more granular and distinct.

Most beautiful specimens are prepared as follows:

A thin section is made from the head of the femur of a recently killed frog and placed on a slide and covered with a

drop of hæmatoxylin. This is allowed to remain until the section is stained a deep uniform color, when it is washed off. A drop or two of acetic acid is added and allowed to remain on the section for a few moments. The strength of the acid used will depend upon the degree of coloring imparted to the tissue by the staining. If the coloring was deep, the acid should be of full strength, if not so deep, then from a 10 to 20 per cent. solution should be used. By this method the matrix is stained but slightly if at all, the cells more deeply, and the nuclei most intensely. The spaces between the cells and matrix are now very distinct and the whole specimen shows everything to be desired. The sections are best preserved in glycerine. The hæmatoxylin should be very strong for this process.



Hyaline Cartilage. x 400.

Chloride of gold is here also highly recommended. The section is placed in a 1 per cent. solution for 15 or 20 minutes, then exposed to the light in distilled water for 24 to 36 hours, and finally mounted in glycerine. The cells are stained violet and they are not caused to retract from the matrix, the nuclei are colored a reddish tint and the matrix is scarcely stained at all.

Thyriod cartilage of the swine. The basis substance is divided into cell-districts by means of chlorate of potash and nitric acid. (Frey).

Osmic acid is useful in that it stains all fatty matter black; it also stains the corpuscles a deeper yellow than the matrix.

Picrocarmine is a satisfactory stain.

Carmine will give good results if the sections be left in the staining for a sufficient time until they are stained a deep uniform red color; the excess of carmine is washed away with water and a few drops of a 5 per cent. solution of glacial acetic acid are added. The sections are carefully watched under a low power, until the staining is seen to leave the matrix, when the acid is removed and glycerine added. It may be necessary

to add the glacial acetic acid undiluted to accomplish the desired result. The general effect is the same as that resulting from the use of the hæmatoxylin as recommneded above; in each case the staining fluid must be strong and the sections over-stained at first.

The cartilage cells are quite difficult to preserve unaltered. A ½ per cent. solution of alum will preserve their natural appearance for some time.

The cell districts may be shown by simple hæmatoxylin staining. The matrix will not take the staining uniformly, some parts showing a deeper color than others.

Digesting the cartilage in water at 100° Fahrenheit will mark out the districts also; so will sulphuric and chromic acids, or a mixture of nitric acid and chlorate of potash.

PIGMENT CELLS.

Pigment cells are much more common in the lower than in the higher vertebrates. In the lower animals the connective tissue cells are filled with pigment granules of various colors from a jet black to a greenish or gray. Here the cells have long processes which anastomose with each other. The processes constitute about all of the cell, for only a nucleus is present where the body of the cell is usually found. These cells are capable of altering their shape, for when subjected to certain irritants they can withdraw their pigment processes entirely, becoming changed into a round spherical body with a central nucleus. This change is under the control of the nervous system and accounts for the rapid changing of color observed in many animals. It will be understood, however, that the contraction of the pigment processes does not necessitate the contraction of the whole process of the cell, for only a portion of the process of the cell is occupied by pigment. The cells may be spindle-shaped, or long and narrow. They appear sometimes as large, flat plates, perforated with holes. The variety of shapes is largely due to the state of activity of the cell when undergoing examination. In the

Pigmented connective tissue cells. x 400.

active state the processes disappear, being withdrawn into the cell body, while in the passive state the processes are of various number and lengths. Brücke has shown that when these cells are in the active state and their processes withdrawn then that particular part of the tissue will be brighter and lighter. He showed that darkness stimulated the cells; they contracted and the skin became lighter. Sunlight left the cells in their passive state and the skin became darker. Pouchet made the interesting discovery that when the retina of certain fishes was stimulated by light, as a result of reflex action the contractility of the pigment cells of the skin was influenced.

Pigment cells from the tail of the tadpole. x 400.

In man, pigment cells are limited almost exclusively to the eye. When examining the web of the frog's foot, or the tail of the tadpole for the circulation of the blood, branched pigment cells are seen in abundance.

ORDINARY VS. SERIAL SECTIONS.—A writer in Nature says "there is a tendency in certain histological schools to neglect almost entirely the older and simpler methods of cutting sections. Serial section cutting is now such an important item in all morphological work, that it is apt to be used to the exclusion of the older methods which give in many cases undoubtedly better histological results."

STARCH GRAINS.—Starch grains in the cells of potato can be beautifully shown by first partially drying the part from which sections are to be made, thereby aiding materially the process of cutting. Remove from a fresh tuber a prism one-fourth to one-half an inch in diameter and an inch or more in length. Expose for a few minutes to moderate heat (hot air from a register is excellent) until the *surfaces* are quite free from moisture, then allow to remain in the ordinary air of the laboratory for twenty-four hours. The consistence will now be excellent for cutting, and clean cells without ragged remains of ruptured ones may be seen beautifully filled with starch like baskets of fruit. Mount in water. Stain if desired in iodine. T. J. BURRILL.

SELECTIONS.

THE BLOOD-PLAQUE AND COAGULATION.

The two most notable papers that have appeared for some time on the physiology of the blood are "Cartwright Lectures," by Professor William Osler, on "Certain Problems in the Physiology of the Blood-corpuscles," and a paper by Mr. George T. Kemp, Fellow of Johns Hopkins University, "On the so-called 'New Element' of the Blood and its Relation to Coagulation," published in *Studies from the Biological Laboratory*, Vol. III, No. 6. Dr. Osler's first lecture deals exclusively with the blood-plaque, while in his third he treats of the relation of the corpuscles to coagulation.

As is well known, the blood-plaques have been variously designated as elementary corpuscles, globulins, granular *débris* or Schultze's granular masses, hæmato-blasts, and Bluttplättchen (by Bizzozero). In preference to the literal translation of Bizzozero's term, blood-plate, both Osler and Kemp have adopted the term blood-plaque as being more euphonious. Various writers have referred to this element as the "third corpuscle," but the objections to this term are so grave that it has been practically abandoned. The plaques may be described as minute elements circulating in the blood plasma with the other corpuscles, and possessing such specific and distinct characteristics that they must be numbered among the normal histological constituents of the blood. Dr. Osler gives their size as from one-sixth to one-half that of a red corpuscle, which is sufficiently accurate for elements showing such variations in size. Sometimes, however, a plaque may be found which measures as much as 5 mm. It is a circular disc, with a smooth, well-defined margin, and occasionally some are found which show a bilateral depression. "It is a homogeneous, smooth, structureless protoplasm, of a light grey color, and in the unaltered state no nucleus can be found." As to whether a nucleus is found after staining there is considerable dispute. After the blood has been withdrawn from the vessels two peculiarities of the plaques occasion a serious hindrance to their recognition as special elements of the blood: the rapidity with which the protoplasms alter, and their tendency to adhere to one another and to sub-

stances with which they come in contact. So long as they are kept in the vessels they do not seem to change more rapidly than the corpuscles, as Osler has found them unaltered in the pial vessels of man some hours after death; and well-preserved plaques may be found enclosed in fibrin taken from the body some time after death.

What is the origin of the plaque? More than half a dozen answers have been given to this question, and experimental evidence has been adduced in support of each answer. So long as the red and white corpuscles were the only recognized histological elements of the blood it was most natural for any observer to connect the plaques and masses with one of these elements. They have been variously regarded as hæmatoblasts, or young red corpuscles; as derived from the red corpuscles; as derived from the white corpuscles; as nuclei floating free in the blood; as fibrin; and finally as independent elements. It seems scarcely worth the while to mention the evidence upon which these views have been founded. Suffice it to say that the views are carefully examined by Kemp, and sufficient evidence brought against them (save those which claim that they are hæmatoblasts or independent elements) to render them most improbable. That they are not due to changes produced in other elements after the blood is drawn is shown by pricking the finger through a drop of osmic acid, by which process all the elements of the blood are immediately set when they leave the vessel. Furthermore, we could scarcely ask for more conclusive proof than that five competent observers—Bizzozero, Lavdovsky, Hlava, Schimmelbusch and Osler—have seen them circulating in the vessels of the mesentery, and in the uninjured vessels of the connective tissues of young rats. Kemp's opinion is that there is no doubt that the plaques exist in the blood, and we have not yet sufficient evidence to believe them to be other than an independent morphological element—a view which is held by Max Schultze, Osler, Bizozzero, Laker, Lavdovsky, Halla and Schimmelbusch.

Careful and painstaking enumerations as to the presence of the plaques in the various acute and chronic diseases have not been made, but Osler draws the following conclusions from numerous observations: (1) The plaques are increased in all

chronic wasting diseases—cachexiæ—with or without fever; debilitated persons, the subjects of phthisis, cancer or other chronic wasting diseases present a marked increase. In phthisis the ratio of the plaques to the red corpuscles may be as high as 1 to 5. (2) In acute sthenic fevers they are not increased in the early stages. As the disease advances, however, and the patient becomes weaker and more debilitated the increase is marked as a rule, This is especially well seen in typhoid fever, in which during the first week the number of plaques may not rise above normal, while in the third and fourth weeks there is usually a large increase. (3) In the so-called blood diseases the number of the plaques is variable. For example, many observers have noticed large numbers in certain cases of leukæmia, but in other cases the increase is not apparent; and the same is true of lymphatic anæmia. In some cases of Hodgkin's disease Dr. Osler has seen the plaques in very large numbers; they may be scanty in profound anæmia; and in cases of pernicious anæmia the clusters of plaques may be almost absent, or much more scanty than in health.

It must be acknowledged that the theory of Hayem, that the plaques are hæmatoblasts, is strongly supported. He believes that the red discs are nucleated, and in an article in the *Archives de Physiologie* three years ago he asserted with confidence that the plaques are nucleated. If, as Hayem asserts, the plaques are biconcova, this is another point of resemblance. Laker agrees with Hayem on this point, but Bizzozero and Schimmelbush assert that they only become biconcova when drawn into a salt solution or Hayem's fluid. Kemp, however, asserts that in addition to seeing them on edge and making out their characteristic dumb-bell shape, he has succeeded several times in seeing them roll over and over in a very slow current, so that at least in *osmic acid* and Hayem's solution he was able to convince himself beyond all question of their biconcavity. The biconcavity is also shown in a photograph made from a specimen stained with Bismarck brown. Afanasef regards Hayem's "nucleus" as only a precipitation of granules in the center of the plaque, and Schimmelbusch takes a similar ground. Kemp has failed to see anything which he regards as a nucleus, and thinks that the concavity seen when examining full on the surface may be very probably mistaken for a nucleus.

As in the case of the red corpuscles, the question of a cell-membrane may be raised in regard to the plaques.

Still another point of resemblance between the red corpuscles and plaques is that, under certain circumstances the latter will shrivel and become crenate; and Kemp says that it is quite a usual thing to see both plaques and red corpuscles caught at one end and drawn out by a current so as to present a long, pear shaped or even threadlike appearance. According to Hayem, again, the plaques contain hæmoglobin; a view which is supported by Mayet and Laptschinsky, the latter having described corpuscles about one-third the size of the red corpuscles, which are sometimes more strongly colored than usual, and sometimes colorless. Riess, Bizzozero, Laker, Hlava, Halla and Schimmelbusch take the view that the plaques are without color, and Kemp has tried in vain to find hæmoglobin in them, even with the double staining fluid of carmine and indigo-carmine, which is claimed to stain green any cell containing hæmoglobin. Another point of relation between the plaques and red corpuscles, pointed out by Hayem, Bizzozero and Lavdovsky, is that in different animals the size of the plaques always varies in the same ratio as that of the red corpuscles. To this point Kemp adds that in trying to get a preparation from which to make a photograph of the plaques, he tried ten different staining fluids on the blood after hardening in osmic acid, and *in every case* the plaques and red discs stained proportionately.

Hayem further supports his hæmatoblast theory by the assertion that in pathological conditions of the system where "new blood" is demanded, we may always find the plaques in increased numbers—which fact had already been stated by Reiss. But there is an objection to this assertion which is so great as almost to necessitate a Scotch verdict. Kemp says: "The sources of error in all numerical determinations of the plaques are very great, on account of the tendency which these elements have to adhere to each other or to any foreign body with which they come in contact. I was early led to see that for this reason numerical determinations, where the blood had to be measured, were practically of little value. The same point has been made by Schimmelbusch, who, in addition to

the results of his own observations, has shown that enormous variations exist in the results of the same observer, while different observers have shown diametrically opposite results, in determining the number of plaques in certain pathological conditions. I think the only way to obtain a reliable numerical determination of the plaques would be to prick the skin through a drop of osmic acid, examine a thin layer of this mixture, and count the relative number of plaques and red corpuscles. A separate determination would then have to be made by the usual methods for the red corpuscles, from which the number of plaques could be calculated. Even this method would not be free from error, for Hayem has shown that enough plaques adhere to the edges of the wound to make an appreciable difference in the extravasated blood. Probably the most suggestive observations in support of the hæmatoblast theory were made by Hayem, who has found the plaques in the vaso-formative cells of the mesentery of newly-born kittens, where the young red blood corpuscles are in process of development, while both Hayem and Pouchet have described intermediate stages between the plaques and the red corpuscles.* We cannot regard the hæmatoblast theory as proved, but we must acknowledge that the relationships between the plaques and the red corpvscles are most striking; and it seems as though this is the most plausible explanation offered."

We have now come to the question as to the relation of the plaques to coagulation, which will be discussed in the next issue of the journal.—Editorial in the *Journal of the American Medical Association.*

INTRAMOLECULAR RESPIRATION.—Intramolecular respiration is not a phenomenon of decadence, but is connected with the vitality of the cells. Respiration is a true process of direct oxidation.

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*The observation of Hlava may also be taken in support of Hayem and Pouchet; the colored bodies which he distinguishes from the plaques being plaques containing hæmoglobin, and on the way to form red corpuscles.

THE TELEPHONE OF 1664.

And as glasses have highly promoted our seeing, so 'tis not improbable, but that there may be found many mechanical inventors to improve our other senses, of hearing, smelling, tasting, touching. 'Tis not impossible to hear a whisper a furlong's distance, it having been already done; and perhaps the nature of the thing would not make it more impossible, though that furlong should be ten times multiplied. And though some famous authors have affirmed it impossible to hear through the thinnest plate of Muscovy glass, yet I know a way, by which it is easy enough to hear one speak through a wall a yard thick. It has not yet been thoroughly examined, how far Otocousticons may be improved, nor what other ways there may be of quickening our hearing, or conveying sound through other bodies than the air; for that is not the only medium, I can assure the reader that I have, by the help of a distended wire, propagated the sound to a very considerable distance in an instant, or with as seemingly quick a motion as that of light, at least, incomparably swifter than that, which at the same time was propagated through the air; and this not only in a straight line, or direct, but in one bended in many angles.—*From works of Robert Hooke, published in 1664.*

WHAT TO WORK WITH.

It is often a matter of question with the beginner what objects shall be examined with the microscope.

The answer, roughly speaking, would be *everything;* for whatever is not already small enough, can by proper treatment be reduced to the proper dimensions. For this purpose Nature has a great storehouse of hidden treasures, which she is ever ready to render up to the dilligent seeker. Field and woodland, hill and valley, earth and water, are ever at hand, teeming with wonders, many of which, too minute for the eye of man, only reveal their beauties to the microscope,—the king of the invisible.

If you understand taxidermy, you will find that the birds and mammals which you handle will afford abundant material for your microscope.

Observe specimens of the feathers, hair, bones, and internal organs; the fresh fluids of the body (blood), the many parasites which may be found *on* and *in* all living creatures.

Sediments from various liquids may be examined, by placing a drop on a clean slide and covering.

Conical wine glasses are those best adapted for collecting sediments.

In this way the settlings of stagnant rain-water, pools, etc., may be studied.

Very interesting material may often be collected in a little muslin bag tied to a faucet, through which the water is allowed to run slowly for an hour or two.

The common articles of food furnish exceedingly interesting specimens. Adulterations may thus be exposed after a little practice. The microscopic examination of drinking fluids often determines whether they are fit for use or not, by revealing the animal or vegetable matter which they may contain.

The insect world offers a delicate and beautiful anatomy for study. Observe the 7,000 divisions in the compound eye of the house fly; the delicate scales from the wings of moths and butterflies; the trachea, or breathing tubes; the suckers on a fly's foot; and hundreds of other parts.

Wonderful things are open to us in the world of plants. The structure, growth, and development of vegetable life are alone enough to keep one busy for years.

Thin scales of minerals may also be examined, thus adding much to the interest of that branch of science.

But these things are not always at hand or to be had, therefore specimens whenever obtained should be preserved for future use. Prepare during the summer for the winter's work. "Take time by the forelock," and whenever you see anything which you think may be of interest, label and preserve it, as described in the chapter on preparing objects.

Animals and birds, if small, may be placed whole in a seventy per cent solution of alcohol, first making an opening into the abdominal cavity, to allow the fluid ready access to the internal parts. Hair, feathers, and the like may be placed in envelopes properly labelled. Parasites, small insects, etc., may be placed in spirits in homœopathic pill bottles. Intestinal

parasites from birds and small mammals may be obtained by slitting the intestine open in a dish of water.

The above are a few examples of materials easily within the reach of any one possessing a microscope. If they are handled as directed in the preceding pages the beginner cannot fail of success, and with patience and perseverance he will soon acquire a knowledge of the microscope and microscopic technique that will always prove a source of pleasure and profit.

In this busy life we cannot spend too much time observing Nature and learning her ways. "People grow better," says Daudet, "for listening to Nature, and those who love her do not lose their interest in men."

Whatever brings us closer to Nature's heart, brings us nearer to that Supreme Being who has created all things.—W. P. MANTON.

CONTENTS OF AN OVARIAN CYST.

They can without the microscope be distinguished from ascitic fluid by the fact that, even after twenty-four hours, they do not coagulate like the latter.

With the microscope we find in the liquid of an ovarian cyst, almost constantly, almost pathognomonically, *cells* measuring five to thirty μ, with a granular appearance, and frequently with plainly distinguishable fat-globules; occasionally *cholesterin crystals*, well crystallized; *leucocytes*, *red blood-corpuscles*, *fat-globules; colloid concretions* in cysts with inspissated contents (they have an irregular shape, are homogeneous, and of a pale-yellow collor); *detritus* in cysts which have been repeatedly punctured; *ciliated cells* (important for differential diagnosis from ascites) lining the walls of the cyst; *pavement epithelium* is not of diagnostic value, the serous membranes having the same lining.—PEYER.

THE SIZE OF THE SPIDER'S THREAD.

I have often compared the size of the thread spun by full grown spiders with a hair of my beard. For this purpose I placed the thickest part of the hair before the microscope, and from the most accurate judgment I could form, more than a hundred of such threads placed side by side could not equal the

diameter of one such hair. If then we suppose such an hair to be of a round form, it follows that ten thousand of the threads spun by the full grown spider when taken together, will not be equal in substance to the size of a single hair.

To this if we add that four hundred young spiders at the time when they begin to spin their webs, are not larger than a full grown one, and that each of these minute spiders possesses the same organs as the larger ones, it follows, that the exceedingly small threads spun by these little creatures, must be still four hundred times slenderer, and consequently that four millions of these minute spiders' threads cannot equal in substance the size of a single hair. And if we farther consider of how many filaments or parts each of these threads consists, to compose the size we have been computing, we are compelled to cry out, O what incredible minuteness is here! and how little do we know of the works of nature! — *Written by Leuwenhœk in 1685.*

PROFESSOR VIRCHOW ON PATHOLOGY AND DARWINISM.

In an article contributed to the current number of his *Archiv.* Professor Virchow replies to some views enunciated at the Strassburg conference of German naturalists and physicians by Dr. Weismann upon Darwinism and Pathology. The question gains interest from the facts adduced by Mr. Sutton in the first of his recent lectures before the College of Surgeons, for Professor Virchow's contention is the same as that of Mr. Sutton—viz., that variations from the animal type are largely brought about by deviations in structure strictly speaking pathological. Dr. Weismann, on the other hand, contended that such variations are the result of the law of adaptation, and it is the position which Virchow contests. He points out that Darwin himself, although not a pathologist, recognized the want of a clear line of distinction between monstrosities and mere variations. Weismann, however, went so far as to deny the inheritance of *acquired* properties; but it is difficult to see how otherwise one is to express the changes induced by adaptation to the environment. The facts of acclimatization are, as Virchow points out, instances of adaptation, and colonies could not be founded if it did not happen that the powers so acquired

were transmissible to posterity. Weismann, on the other hand, regards acclimatization rather as the product of selection, such individuals surviving who, by the possession of inherent qualities, are enabled to live under the changed conditions, and not that they acquire new powers. Much, however, turns upon what is meant by an acquired quality. Weismann means by it such as is imparted by some external agency, and would limit the influence of external causes to unicellular organisms, whereas variation occurs through sexual reproduction. But, as Virchow points out, external agencies ought not to be limited to those which operate outside the organism. In a multicellular organism variation may occur in some cells, through the operation of other cells—i. e., strictly within the body. Indeed, the influence of the sperm-cell upon the germ-cell is an external influence, and, therefore, although we speak of inherited qualities as being internal or predisposing, in strictness the qualities transmitted from the male parent are the result of an external agency when contrasted with those derived from the germ-cell. Applying these considerations to pathological processes, he shows that these are the result of external agents, and that they produce a change in the typical organization, and thus by mere analogy the conclusion is arrived at that many racial—nay, even specific and generic—differences have been brought about by processes which may be deemed pathological. The various factors which determine the persistence of such deviations, and their transmission by inheritance, are not fully known; use and disuse explain some, adaptation accounts for others; but, however explained, the fact that acquired qualities are inheritable remains assured.—*Lancet.*

SEPARATING THE LAYERS OF THE WINGS OF INSECTS.—A wing that has never been dried is placed in 70 per cent. alcohol, then into absolute alcohol, and after a few days immersion then placed into turpentine. After remaining a day or two in the turpentine, the specimen is plunged suddenly in hot water, when the conversion of the turpentine into vapor between the two layers of the wing so far separates these layers that they can be easily parted and mounted in the usual way, as microscopical preparations on a slide.—*Royal Microscopical Journal.*

REVIEWS.

THE ROTIFERA OR WHEEL ANIMALCULES.

This is Part II. of the work. It is to be completed in six parts. This work was noticed in our March number. It is intended to embrace the whole class of the Rotifera; and the original drawings will be taken from life. It stands alone as a contribution to a department to which scarcely nothing has been contributed for nearly half a century.

Further particulars can be obtained by addressing our London agent, whose address is found on the cover of this journal, or by addressing the publishers, Longmans, Green and Co., 39 Paternoster Row, London, E. C., England. The price is ten shillings sixpence.

AMERICAN MEDICINAL PLANTS. By F. C. Millspaugh. Published by Boericke and Tafel, New York and Philadelphia. Fascicle IV.

In the February number of this jounal we called attention to the third part of this exhaustive treatise. It is only necessary now to call attention to the thorough work both editor and publishers are doing. The descriptions are so clear and the illustrations of such a high order that the reader will have no difficulty in understanding and identifying any of the one hundred and twenty plants already given.

THE NATURALIST'S DIRECTORY. Edited by E. S. Cassino. Boston, 1886. This edition contains the names arranged both alphabetically and geographically.

Such a work demands a vast amount of labor on the part of the editor, and the many naturalists, chemists, physicists and astronomers who would find it profitable to possess such a directory, should at once send their subscription to the editor, 137 High St., Boston.

THE CENTURY.

This monthly still continues to number its readers by the hundreds of thousands. This can only result from one thing: the people find in it just what they want to read. The "war series" of papers awakens an intense interest, and the illustrations are the finest examples of what the art of wood-carving can do.

PAMPHLETS AND REPRINTS RECEIVED.

Proceedings in Memory of Louis Agassiz, at Cornell University, 1885. pp. 38.

Notes on the Epithelium lining the mouth of Hectums and Menopoma. By S. A. Gage, Ithaca, N. Y. pp. 2.

Address before Section of Microscopy of the A. A. A. S. By S. H. Gage, Ithaca, N. Y. Delivered at the Ann Arbor meeting, 1885.

Thoughts on Science Teaching. By Alexander Winchell, Ann Arbor, Mich. pp. 15.

Sources of Trend and Crustal Surplusage in Mountain Structure. By Alexander Winchell. pp. 4.

Science and the State. By Alexander Winchell. pp. 44.

Anthropomorphism. By Alexander Winchell. pp. 26.

Address before the section of biology of the A. A. A. S., at the Ann Arbor meeting. By Burt G. Wilder, Ithaca, N. Y. pp. 20.

On the Microscopic Examination of Butter. By John H. Long, Chicago, Ill. pp. 5. Illustrated with 8 figures.

Some Points on the Micro-chemistry of Fats. By John H. Long, Chicago, Ill. pp. 10. Illustrated with 24 figures.

We have just enjoyed a call from Mr. Turner of the Gundlach Optical Co., of Rochester, N. Y. Mr. Turner brought the very latest products of Mr. Gundlach's acknowledged genius. One new piece of work is a one-fourth objective changeable to a one-inch. Another is a one-twelfth dry objective, of 165°, especially made for work on the bacteria. It has the advantage of being used dry, of giving plenty of light, and of having a good working distance. The priee is also very reasonable indeed, $40. Mr. Turner says they are coming rapidly to the front, and they intend to push things in the future more than ever. Myrowitz Bros., of 297 Fourth Ave., New York, handle their goods now exclusively.

The Palmer slide Co., of Geneva, N. Y., now offer not only their beautiful beveled slides, but they also offer the Pillsbury cabinets, the Pillsbury mailing cases, the Syracuse solid watch glasses, mounting media, stains, and microscopists' slides in general. Send for their late circulars.

RESPIRATION OF LEAVES IN THE DARK.—Leaves placed in an atmosphere of carbonic acid, in the dark, absorb a considerable quantity of the gas.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

WANTED—Good Zentmayer Microscope Stand, Binocular preferred, none but a first class instrument. M. DE BALD, 136 Goodell St. Buffalo, N. Y.

FOR EXCHANGE.—Fiddian Microscopic Illuminator, brass injecting syringe, Dr. Seilers section knife, warm stage with thermometer and gas chamber, "Archiv für Microscopische Anatomic," bound; in exchange for first class Polariscope, collection of thin, mounted rock sections or collection of minerals—would also exchange for books, geological reports, or books on Mineralogy, Lithology and Geology. HENRY FROEHLING, 17 South 12th Street, Richmond, Va.

FOR EXCHANGE.—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially esired. ROBT. W. WOOD, JR., Revere St., Jamaica Plain, Mass.

FOR EXCHANGE.—Mounted sections of injected lung of guinea pig.
CHAS. BLASDALE Jericho, Queens Co., N. Y.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

SEEDS of Orthocarpus Purpurascens and slides of same in exchange for other objects mounted or unmounted. EDWARD GRAY, M. D., Benicia, California.

WANTED—Well cleaned and selected Foramenifera for which cash will be paid or slides given.
EDWARD G. DAY, Riverside, Conn.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

ACARI INSECTS, pathological and other well mounted slides. in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M.D., Geneva, N.Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W, WESTOVER, M. D., St. Joseph, Mo.

WANTED.—A copy of No. 1. Vol. IV., The Microscope; will give slides in exchange, or cash.
Very Truly, HENRY FROEHLING, Richmond, Va.

WANTED.—Unmounted material, any kind; foram-inifera and diatoms preferred; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

WANTED.—Good 1-4; spy glass; will exchange good objectives, including new Gundlach 4-10 of 80°. C. OUDERDONK, Rugby, Tenn.

WANTED.—Micrographic Dic'y, 4th ed. Will give Wales 1-10 immersion, 135°.
DR. ED. GRAY, Benecia, Cal.

FOR EXCHANGE—Cathcart's ether freezing microtome, complete. Would prefer an injecting syringe. A. B. AUBERT, Orono, Penobscot Co., Maine.

WANTED—No. 5 of Vol. 2, and No. 1 of Vol. 3. This journal. Who can supply?
D. HUMPHREY, Lawrence, Mass.

FOR EXCHANGE—A new mechanical finger for a copy of Beale or Carpenter; slide of grouped diatoms for French objective, ¼ in. focus. HAROLD PLOWE, 136 High St., Peoria, Ill.

FOR EXCHANGE OR SALE—Wood sections, mounted or unmounted. Also few mounts of water-washed diatoms. H. M. RICHARDS, Sadsburyville, Pa.

WANTED—Micro-dictionary, 1 in. objective, accessories, rare diatoms, etc., for rare and ordinary slides. Please exchange lists. R. E. WOOD, St. Helena, Napa Co., Cal.

THE MICROSCOPE.

VOL. VI. ANN ARBOR, AUGUST, 1886. No. 8.

ORIGINAL COMMUNICATIONS.

DESMID FISHING.

C. L. WILBUR, HILLSDALE, MICH.

ONE of the most thoroughly charming and fascinating fields of study for the young microscopist and student of botany is the collection and comparison of Desmids. Readily identified by reference to the splendid and comparatively inexpensive Manual of WALLE, their bright and pleasing color, the many and striking variations of form running through the different genera and species (500 v. s., *Walle*)—yet always so preserving the fundamental character of the order as to easily lead them to be regarded as only varying loci in space (in Microsterius and others, reduced nearly to two dimensions) of some general equation which may hold, summed up within itself, all the wonderful possibilities of their development,—and, again, the mysterious motion of their "dancing granules" and "swarming motes," must ever render them interesting and suggestive objects of study to workers with the microscope. Adding to this their occurence—while plentiful, yet not so numerous as to take away all the zest of discovery—and their average and extreme limits of size, which render their examination, separation and permanent mounting a pleasant and easy task even to the beginner, and we have the elements of a most admirable introduction to the use of the microscope in life-study: at once training the hand to delicacy, the mind to familiarity with and appreciation of microscopical dimensions, and, at the same time, introducing the young observer to the many forms of vegetable and animal life which he will meet with in his quest (and which he may well set aside for subsequent systematic study.)

It is in reference to this, the separation (for comparison, special microchemical treatment or permanent preservation) of

Desmids and similar objects from the foreign matter with which they are associated in nature, that a few directions may not be amiss. The following method, although extremely simple, is new to me and as I have seen no hint of the same in any of the common microscopical books or journals to which I have access, I trust that it will prove new and valuable to some of the younger readers, at least, of THE MICROSCOPE—such as must draw their methods either from these popular works or from their own experiments.

I use for separation, etc., a set of suction-tubes, five in number, increasing and decreasing in fineness from No. 3, which is large enough to comfortably admit a *cosmarium tetraophthalmum*. These are ranged on a small wooden rack placed on a box of convenient size at the right of the microscope and are fitted in, as needed to a small fiexible white rubber tube; this fits over one of two glass tubes put tightly through the stopper of a 1 oz. wide-mouthed bottle and to the other tube is fitted a second one of rubber which is held in the mouth while at work or fitted to a convenient mouth piece. The tubes are filled with water on beginning work to a height sufficient to satisfy capillary attraction. Then, working e. g., under Iin. objective, B eyepiece, the point is brought nearly to surface of pool on slides and moved to-and-fro horizontally till shadow is seen in field; thence quickly brought with point close to object. After a little practice the proper point can be inserted and instantly brought to object without taking the eye from the field. It can now be sucked in and transferred to little pools of 50 p. c. glycerine on a "collecting slide," parcelling off like forms, different sizes, etc., or, by alternately expelling and drawing in the breath, the object can be rolled over and over by the current from the tube thus showing all sides.

I ordinarily take samples with a small pipette, place on slide and spread out and break up foreign gelatinous masses with a curved glass needle set in a match stick as a handle. I first give a preliminary running over with 50.100 diameters for larger forms and then, taking care that the pool is shallow enough to avoid contact with objective and occasionally replacing water lost by evaporation, run down with $\frac{1}{4}$ in. or $\frac{1}{8}$ in. objective and take out the smaller species. Finding, for exam-

ple, a *Pediastrum tetrus* or small *Cosmarium* under the higher power, I turn on the 1 in. (a nose piece is indispensable), run back, remove the small speck and place him in the little pool containing his brethren that have gone before him. Docidiums and long strings of filamentous Desmids are safely taken up by holding the tube in the direction of their length and expelling them with tube held nearly horizontal to avoid injury from flexure. A very little experience will enable the beginner to transfer with *certainty*, ease and rapidity any object he can make out under 250.500 diameters. It is a pleasure to find, on running down again with high power, the field undisturbed in relative position of objects except that the one desired is missing.

This method is of course equally applicable to separating Diatoms or any minute objects which it may be desirable to preserve. Mosses, etc., too large to enter tubes can be sucked against their ends and there held while being transferred. Further, in microchemistry, minute crystals can be taken up from plant sections, moved to a clean portion of the slide (or better to a piece of thin (cover) glass held in a match stick handle which admits the application of heat when needed) and then treated with solvents, etc. For the use of re-agents. in order to avoid the undue multiplication of tubes and the contamination which would result from using the same tube for more than one re-agent, I use little *test-points*—formed by drawing out small glass tubing—with bulging body and short tapering shank which is inserted in a small hole passing through a cork stopper which closes a glass tube (3 in. x 5-16) the other end of which is drawn out and cut off to admit of substitution for a fishing tube. These points are kept on a convenient tray or large watch glass and being charged with various liquids permit the ready and perfectly controlable application of any test or stain to very small quantities of matter. Precipitates can be formed, re-disolved, etc.

The Desmid tubes, test-points, etc., can be fashioned by any one, after a few minutes practice, from small glass tubing by aid of the blow pipe. A common kerosene lamp furnishes a good enough flame for the purpose. To prevent blackening of tubing (containing lead) it must be kept out of the inner, luminous reducing flame.

EDITORIAL NOTES.

SALUTATORY.

With this issue THE MICROSCOPE passes into new hands. The present editors and proprietors are not, however, entirely unknown to many of the readers of this journal, and to such old friends, as well as to the many new ones whom we now appropriate unto ourselves, we extend the hand of fellowship and greeting. Many of you will feel a sense of loss, no doubt, at the change which has placed new faces in the editorial chair, where for six years the smiling countenance of Prof. Stowell has beamed upon the microscopical world. But be not too hasty in your condemnation, for in our quadruple capacity we have all casts of physiognomy, from the "lean and hungry" visage, to the round and jovial front, and so we are prepared for all emergencies.

What we propose to do with THE MICROSCOPE will be stated hereafter, but at this time we may say this much, that the journal will be kept up to its present high standard, and, if we are able to accomplish what we now have in mind, great improvements may be looked for in the near future.

In order to effect this, however, we need not only the support and sympathy of all of our present subscribers, but also many new names must be added to our list. And when

"We've got you on the list,"

we are quite sure that you will remain. Will you not aid us in carrying on the good work of continuing this, the only journal of its kind in the

"Wide, wide world."

VALEDICTORY.

For a long time it has been known to a few of our friends

that the health of the Junior Editor of this journal has been seriously impaired. This has necessitated an unusual amount of labor and care on the part of the Senior Editor. There seems at present no bright solution of the problem. For this reason only we entertained the proposition of some of our friends. This finally results in the transfer of our journal to four most competent microscopists, experienced equally in manipulative skill and editorial work. We transfer to them a journal that has more than paid its expenses each year of its existence, and that, without doubt, paid more net profits last year than the whole profits of all the microscopical journals ever published in this country from their first appearance to the present time. Our journal has made us many friends, and in this alone has repaid us a hundred fold for all our anxieties and labors. To all our contributors, who have made the pages of our journal bright and instructive; to all our subscribers, who have aided us both by their payments and their promptness; and to all our advertisers, whose interests, we trust, have been furthered by our efforts, to all these, we give our hearty thanks and our last good wishes.

CHARLES H. STOWELL.
LOUISA REED STOWELL.

INTRODUCTORY.

It is with great pleasure that we are able to introduce to our friends four such competent workers as are represented on the new editorial staff of this journal. Dr. W. P. Manton, M. D., F. R. M. S., is a graduate of Harvard and an experienced editor. For over three years he studied in the principal cities abroad, and for a long time was a special pupil of the renowned microscopist Prof. Butschli, of Heidelberg. He is well known to thousands of readers through his admirable "Practical Helps

to Natural History." Four of these works are now before the public and the manuscript for others is well under way.

Dr. Geo. Duffield is the present Secretary of the Michigan State Medical Society. He has studied under Arnold at Heidelberg, and has paid special attention to the subject of Pathological Anatomy.

Dr. C. G. Jennings is well-known both as a teacher and as a very skillful and successful worker with the microscope.

Dr. Frank W. Brown has pursued microscopical studies abroad, and is at present the Professor of Histology and Microscopy in the Detroit College of Medcine. C. H. S.

All who have not renewed their subscriptions will confer a favor on the new publishers by remitting their dues at once. For the present, communications of all kinds can be addressed to Dr. W. P. Manton, 83 Layfayette Ave., Detroit, Mich.

C. H. S.

The new "editors and publishers" commence their active work with the September issue of this journal. We shall be pleased to speak to our old friends through these columns; and the new proprietors have kindly promised us this privilege. We have an illustrated article ready for their first issue.

C. H. S.

AT LAST.—Our readers may not all be aware of the completion of a very interesting little drama, in the city of Washington, during the past month.

It was not a surprise to the senior editor of this journal and has been predicted by him as one of the things surely to come to pass. We thought it would occur on the first of January last but we guessed just six months too soon. After six and one-half years of exhaustive editorial work the amiable editor of the *American Monthly Microscopical Journal* gracefully retires.

It would not take a shrewd guesser long to find the intended home of our beloved friend. We believe he will meet with the highest success among his Japanese acquaintances. We commend him to them, and would only suggest that they refer all questions, requiring calm judgment, even temper and general loveliness of character to render a just answer, to him to solve. That he possesses these one has but to consult the pages of his journal before the time that Cassino tried so hard to put it upon a paying basis.

Nearly one-half of our subscribers were with us when this "special correspondent from Japan" tried in every possible way to defeat us. Because we were so young, we could be easily put out of the way, was his thought. Through all this bitter strife on his part, a few friends have commended us for our patience and forbearance. Did all our subscribers know the facts in our possession they would think our seemingly harsh words were mild indeed. More than once do we believe we have had it in our power to cause our rival publication to suspend. To obtain positive proof we sent special messages across the water and with but one result. We knew if we had our health that the day was not far ahead when the present situation would arrive.

His journal was the only one that did not receive us kindly and the only one that has not always been ready to do us a favor. If we have contributed, by our persistence and perseverance, to bring abovt the present affair, then we congratulate ourselves and feel almost ready to cry aloud, "It is enough." We would like to ask Mr. Hitchcock three questions, to each of which we can give an affirmative answer.

Has your journal paid expenses each year?

Has your advertising alone been sufficient to pay these expenses?

Has your subscription list alone been sufficient to pay these expenses?

Aren't you glad you are going to Japan? To the new management of the journal, whoever and whatever that may be, we extend the hight hand of fellowship. There is room for us both. We will aid you in any reasonable way and you will al-

ways find us ready to further the interests of American Microscopy.

GIVE PROPER CREDIT.—Since Dr. James left *The National Druggist* its microscopical department has amounted to nothing. Every occasion possible has been used to aid the Washingtonian struggle. All this we enjoy, but when it comes to a positive misstatement of facts then patience ceases to be a virtue. The editor tells what great pleasure he derived from a short conversation with Mr. W. H. Walmsley. He might well have added that he was profited as well as pleased by this short meeting. For these two could not converse without this accurate editor being greatly profited thereby. This editor then proceeds to tell the readers of *The Druggist* how he has "several times called the attention of our readers to the series of articles by Mr. Walmsley on photo-micrography in the *American Monthly Microscopical Journal.*" This is rich! We had supposed Mr. Hitchcock was the author of those articles, and that he commenced them in the very next number following the one in which we announced the fact that Mr. Walmsley was to contribute such a series to our journal. The truth is Mr. Walmsley did not write those articles for the above-mentioned journal; and further, said editor has not "several times" called attention to Mr. Walmsley's articles; and still further he has not called attention to them once. While it is true, as we remarked some years ago, that the difference between *The American Journal of Microscopy* and *The American Monthly Microscopical Journal*, so far as the name was concerned was, indeed, a microscopical one; it is also true that the difference between the latter and THE MICROSCOPE is as great as the difference between the North and the South pole, "all the difference in the world."

YELLOW FEVER INOCULATIONS.—While preventive inoculations of rabies are so frequent, it is well to remember the fact that one of Pasteur's pupils, M. Rebourgeon, has reported on 6,000 inoculations of yellow fever, with no fever infection subsequently, and on seven cases of inoculation of patients with the disease, all of whom recovered.

HIGH VS. LOW POWERS.—In a private letter from Dr. A. Y.

Moore we learn that he still continues to see what can be seen with his high-angled glasses. He has just resolved Nos. 16 and 17 of Möller's mono-brom. plate with his one-sixth objective, using central light, resolving No. 16 into dots. He facetiously adds "beat that with your one-fiftieth if you can." He further adds "and the one-sixth will show a tube cast better than any one-fiftieth ever made." All of this we most seriously do not doubt. A one-fiftieth is not made to study tube-casts, which a good four-tenths will show; neither is it made to resolve diatoms. Such a glass cannot be made to advantage with much greater numerical aperture than 1.17. How can such a glass compare with a one-sixth with the aperture raised to 1.35? So Dr. Moore may take along this line in perfect accord with us; but how will it be when it comes to study the nuclear changes in the very lowest and smallest forms of life? What service would the one-sixth have rendered Dr. Dallinger in working out the wonderful phenomena, so graphically described by him in his presidential address? Who could accurately measure, with his filar eye-piece micrometer, such small bodies as blood corpuscles, with no higher objective than a one-sixth? The whole matter, it appears to us, is best expressed by saying, "there is a place for everything, and everything should be in its proper place." There is a place for a one sixth of 1.35 and Dr. A. Y. Moore has just the proper place for it; there is a place for a one-fiftieth and we are glad we have it.

NEW METHODS AND NEW MAILING BOXES.—Mr. J. D. Beck, of Liberty, Pa., sends us a box containing half a dozen slides. The slides show the result of his new method of double-staining. This method consists in employing such means, whereby it is possible, after staining, to dehydrate the sections in absolute alcohol without having the color in the least removed by the alcohol. Mr. Beck "does not feel able to give the process to the public but will sell the same to private parties, including one slide, for seventy-five cents." We are not willing to express an opinion on the subject while thus in the dark, but will add that the slides are good illustrations of double-staining of vegetable sections. The box is also an invention of Mr. Beck. This consists of a block of wood the length of a glass slide and of any width desired. Grooues are sawed lengthwise nearly

through the block for the reception of the slides. A half-circular or U shaped groove is cut through the center of the block transversely to the grooves mentioned above. This could be done with an inch auger. It leaves a clear place for the mount on the slide. The box is easily made and its cost is nominal.

THE TUBERCLE BACILLUS.—A short time ago we published the claims of an Italian physician, Dr. Cantani, that by inhalations of the spray from infusions containing the common bacterium termo, he was able to influence the course of tuberculosis of the lungs. The report of a number of cases showed that all the symptoms were much mitigated. It will be remembered it was claimed this was due to the fact that the bacillus tuberculosus could not thrive in the presence of the bacterium termo, and as it has been further shown that some species of bacteria could not exist in the presence of certain other species, therefore if certain diseases were caused by certain bacteria we might have great hopes that the special antagonistic bacterium might be found for each special disease-producing bacterium. Granting then that the cause of consumption of the lungs was in the bacillus tuberculosis, and that the bacterium termo, as proved by culture experiments, was the special antagonistic bacterium, then we only had to get rid of the former by introducing the latter. This Dr. Cantani did in the form of a spray, as previously announced, and with the most flattering results. But now comes a certain Dr. Ballagi who claims that he has followed the methods of Dr. Cantani in eight cases, and with the most wretched results. In none of the patients was there a diminution in the number of tubercle bacilli. The fever and cough were unrelieved and in no way was it possible to discern the slightest benefit from the treatment. The appetite was decreased as was also the weight of the patients. Thus we may be far from a solution of these vexatious questions.

NEW CAUSE OF PHTHISIS.—This impression is all the more marked as we consider that already two French observers, MM. Duguet and Hericourt, claim to have discovered a new cause of phthisis. It is found in the common vegetable parasite *microsporon furfur*. When this micro-organism was injected into rabbits and guinae-pigs they became, without excep-

tion, tuberculous. Again it was shown that the cultures of microsporon furfur, of tubercle produced from this fungus, and those from the tubercles of man are exactly the same. Certainly we shall in this connection be obliged to accept the good advice given to "American sceptics" by Pasteur. "Doubt is wise and healthful: but doubters must not expect all their doubts answered at once. Recall Jenner. Could he have satisfied his opponents while he stood on the threshold of his experience? Let your last word be *wait!*" And we are content to *wait.* But while *waiting* we will be active in bringing to bear all the good, old, orthodox methods for the relief and *cure* of all cases of phthisis that may come under our care, without regard to *microsporon furfur*, *bacterium termo*, or *bacillus tuberculosis.*

THE MICROBES OF PNEUMONIA.

Professor Weichselbaum recently presented an elaborate paper before the Vienna Medical Society, in which he gives the results of 127 cases of pneumonia examined, with 87 culture experiments.

The material for the cultures was obtained one or two hours after death,—as well as from the living subject, by means of a Pravaz syringe (hypodermic), introduced into the lung and pleura. He distinguishes four kinds of microöganisms.

1st. The diplococcus pneumoniæ. This is the most common and consists of oval, elliptical, and round cocci, which occur in chains as well as in pairs. The chains are composed of from six to eight or as many as twenty to thirty cocci, and are straight or slightly curved. The cocci are developed in a capsule, which varies in thickness in proportion to their vitality.

2. A variety of cocci resembling the first, but having a greater uniformity in spherical shape, and forming in long, sinuous chains.

3. Staphylococcus aureus or albus.

4. Bacillus pneumoniæ, (Weichselbaum). These consist of rods of different lengths, the smallest, and apparently youngest, being oval. They have a capsule, and correspond to Friedlander's *pneumococcus.*

The first variety was found in ninety-three cases, mostly of croupous pheumonia,—also in secondary forms. The second,

(streptococcus), was found twenty times,—in fifteen cases of primary, and five cases of secondary pneumonia. The third variety occurred in secondary cases only, and mostly where the primary disease was due to this microörganism. The fourth kind was met with nine times, four times unmixed with other forms. All these organisms were most abundant in the earlier stages of the disease,—being scanty or absent in gray hepatization, and, if present, staining badly or unencapsuled. At the margins of the pneumonic focus in the œdematous tissue micrococci were numerous, pointing to the œdema being not a passive process but a precursory stage of pneumonic infiltration, and resembling the invasion of cutaneous tissue in erysipelas. Moreover, inflammatory changes accompanied by these microörganisms were found in the respiratory tract above the lungs. Secondary meningitis in pneumonia was shown to be due to the presence of the microörganisms, which were also found in the serous exudations of pleurisy and pericarditis, which might complicate the lung affection. The bacterial origin of the disease, was, therefore, held to be demonstrated.—*London Lancet.*

STREAMING OF PROTOPLASM.—The streaming motion of protoplasm can be exhibited very satisfactorily in the thin membrane (upper epidermis of scale-leaf) found between the scales of the bulb of the common onion. All that is necessary to do is to transfer a piece of the fresh membrane, snipped off by a pair of scissors, to a drop of water on a slide, cover and examine with a power of four hundred or so times. The temperature of a comfortable room is about right, with less heat the movement is very slow. Success is more certain if the bulb has started to grow, as they often do in a cellar. Care should be taken in removing the membrane, for the cell walls are very delicate and easily wrinkle, forming unsightly and annoying, irregular lines over what should be the clear open cell. The material commends itself for its accessibility at any time, and especially in winter when other things may not be readily obtained, and for the extreme ease of preparation.—T. J. BURRILL, in *Botanical Gazette.*

SELECTIONS.

THE BLOOD-PLAQUES AND COAGULATIGN.

In the last number of *The Journal*, (see this journal for July,) we attempted to give some idea of the blood-plaque, and showed that while there is very strong evidence that it is an independent element of the blood, there are also strong reasons for believing that it is what Hayem terms an hæmotoblast, or yonng red corpuscle. But which of the theories be held matters but little in considering the relation of the plaque to the process of coagulation. This, however, is best prefaced by some account of the histology of the formation of fibrin, and its relation to the histological elements of the blood, including the blood-plaques.

In the study of the formation of fibrin under the microscope it has long been noticed that the fibrin filaments spread out as rather distinct rays from the minute aggregations known as Schultze's granular masses. This was noticed by Schultze, and by Ranvier in 1873, who regarded them as centres of coagulation; and also by Riess, Hayem, Leube, Bizzozero and others. Ranvier, Davidson, Bizzozero and Halla think that there is a distinct and direct connection between the fibrin-threads and the granular masses, but Schultze thinks that the threads do not proceed from the masses, but pass over or through them. Heyl, having observed that in Bizzozero's fluid the number of granular masses increases as the leucocytes decrease, and that both the granular masses and leucocytes stain with methyl violet, has drawn the new unwarranted conclusion that on the assumption that the leucocytes break down during coagulation, the granular masses are derived from the leucocytes. This view has received the support of Hlava and Riess, but is denied emphatically by Osler and Laker; and Löwit, after a careful study of the coagulation of lymph under the microscope, has found nothing that can be regarded as leucocyte detritus. The generally accepted view as to the gaanular masses, then, is that they are formed by the plaques.

In the very careful study made by Kemp he found that the formation of the granular masses by the plaques may be seen

in the following manner: The finger is pricked and a good-sized drop of blood is squeezed out. This is taken immediately upon a cover-slip, and then as quickly as possible most of it is washed off by a jet of a 75 per cent. NaCl solution from a wash-bottle. The cover-slip is now placed on a slide, and transferred to the microscopic stage as quickly as possible. The plaques have the property of sticking to the slip, while the other elements are easily washed away by the jet, so that upon examination the whole field will be seen to be filled with plaques, some of them isolated, but most of them grouped in masses consisting of from two or three to a dozen or more. They are not pale and homogeneous, with a symetrical outline, but appear glistening and granular, and their contour, instead of being regularly oval or circular, has become jagged. These changes are the more marked the longer the time which has elapsed before the preparation is observed; and they may be seen to take place step by step while the observer watches the preparation. The plaques continue to undergo changes in form, until finally when they are grouped together only a granular mass is found, and the individual plaques can no longer be distinguished clearly. "*Pari passu* with these changes processes are seen which run out from the granular masses; and when coagulation sets in these processes are nearly always found to be continuous with threads of fibrin. The threads of fibrin are sometimes deposited as long-needle-shaped crystalloids which are often seen lying free in the field, and not connected with the granular masses; but the greater number are formed most thickly around these masses, from which they often radiate as centres."

Kemp has found that when the blood-plasma is very much diluted but little fibrin is formed. "Under these circumstances the field is comparatively clear, and it can then be seen that no fibrin proceeds from the leucocytes, but all comes from the plaques, or is deposited freely in the field." Hayem and Schimmelbusch have pointed out that fibrin may be formed elsewhere than around the plaques, and this view has been confirmed by Osler; though Bizzozero has stated that fibrin is deposited around the plaques and nowhere else. Osler says in his third lecture that it may be noticed that fibrin appears quite

independently of the plaques, particularly if healthy blood be examined in which plaques are not very numerous. When there is an abundant formation of fibrin the network of threads is seen all over the field, and every spot is full of fibrin; but when the fibrin is not abundant it will almost always be seen that the fibrin is thickest in the vicinity of the masses of plaques. "Even in preparations where the fibrin is sparingly formed, the threads are deposited elsewhere than around the granular masses, and occasionally, though rarely, I have found granular masses around which the fibrin did not appear to lie more thickly than in the clear field. The fact that nearly always the fibrin is deposited most thickly around the granular masses, even radiating from them as centres, while interesting and significant, is not conclusive proof that the plaques are connected with coagulation; for the same adhesive property of the plaques which makes them adhere to each other, may also cause the threads to stick fast as they separate out from the medium around them. This seems all the more probable when we consider that the fibrin as well as the plaques is sticky and adheres to the glass" (Kemp). The fact that in preparations in which the clot is scanty the fibrin is deposited more thickly in the vicinity of the masses of plaques may possibly be due to the plaques giving up something which causes or hastens coagulation, and that in dilute solutions this substance is more abundant in the vicinity of the granular masses than elsewhere.

Laker has taken the ground that the fibrin-threads are folds of a membrane which he calls the primary fibrin membrane; a view almost identical with that taken by Virchow in 1856. Kemp concludes that what Laker describes as a membrane is a layer of the homogenous substance described by Virchow, Rindfleisch and Hermann, which is essentially of the same composition as fibrin, and from which the fibrin-threads are formed by a process very closely resembling crystallization, if not identical with it. Hermann thinks that the threads are formed by a process which closely resembles crystallization, and Schimmelbusch insists most positively that the formation of fibrin-threads is a true crystallization process, nor does he believe that there is a previous stage, either homogeneous or granular. Hayem, though not believing in the fibrinous character of the plaques,

compares the formation of fibrin to a sort of crystallization starting from small crystals already formed. Kemp says: The definite form which the fibrin-threads take, especially the typical needle-shaped form of the threads when deposited isolated in scanty clot, speaks strongly in favor of a crystallization; while the subsequent toughening and contraction of the threads show a clear resemblance to the coagulation of certain proteids, notably myosin. In fact, it appears that we have in blood an interesting process which may be regarded as intermediate, in a certain sense, between a true crystallization on the one hand, and the coagulation of certain proteids, as myosin, etc., on the other. Hence Kemp thinks it evident that there is no histological connection between the plaques and fibrin, so that if the former are involved at all in coagulation the connection must be a chemical one; in other words, the plaques must give up something to the plasma at the same time that they break down. But the strongest evidence of a connection between the plaques and coagulation is derived from facts pointed out Hayem, Bizzozero, Lavdovsky, Halla, and Ferraro: that fibrin is formed *pari passu* with the breaking down of the plaques; and that reagents or conditions which retard the breaking down of the plaques, retard to *precisely the same extent* the formation of fibrin; and reagents which *preserve the plaques prevent the formation of fibrin altogether.* Kemp's observations, so far as completed, confirm these facts in every respect.

The question now arises, what part do the plaques play in the process of coagulation? Hayem and Bizzozero think that their part is to furnish something essential to coagulation, and they agree that *ferment* is in all probability the agent in question. Now, in some experiments Kemp noticed that blood flowing through a dirty tube coagulated more quickly than in flowing through a clean glass tube; and he thinks that this would seem to show that in passing through the dirty tube the blood took up something which brought about coagulation before the plaques broke down, but which is also formed later by the plaques when they break down. And from what we know of coagulation at the present time, he says, it seems probable that the agent in fibrin-formation that would be more likely to act

in this manner is the *ferment.* Osler has examined the relation of the blood-plaque to coagulation experimentally, and his results are very interesting. If an ordinary ligature, partly teased out, be passed through the femoral vein of a dog and allowed to remain for five or six minutes, or less, the threads become coated with the plaques; and the same coating of plaques may be obtained by whipping freshly drawn blood with a bunch of threads, as in Bizzozero's experiment. The threads are then carefully washed in a saline solution, by which the red corpuscles are removed. If the threads be then dipped into a coagulable solution clotting occurs. But Rauschenbach criticizes this experiment by saying that the threads may have absorbed ferment which was not washed away; and that the coagulable fluid used by Bizzozero is only a test for free ferment. Kemp thinks that the first objection is valid, but Osler replies to it by saying that the chief elements in the clot are plaques; and the greater the number of the plaques the denser the coagulum. To the second Kemp replies that by granting it we exclude the leucocytes adhering to the threads from a share in the formation of the ferment, if any is formed by what does adhere to the threads. It then remains to explain why the time of coagulation should depend upon the number of plaques, and the experiment remains of value as offering strong support to the theory that the ferment may be derived from the plaques.

But there is further and more conclusive evidence of the participation of the plaques in the process of coagulation, as afforded by the experimental production of thrombi. So far as completed Kemp's work in this direction tends to confirm the results of Osler, Bizzozero, Hayem, Ferraro and Lubnitzky, who find that the white thrombus is not composed of leucocytes but of plaques; that is due to an agglomeration of plaques around a lesion in the vascular wall, or a foreign body introduced into the vessel. The plaques are the elements which first settle on the edge of the wounded vessel, and form the basis of the clot, as shown by Eberth, though he still holds to the idea that the leucocytes play an important part in the formation of white thrombi. Osler contends that they are composed chiefly of plaques, and that their further development results from the disintegration of the plaques; that a granular

or stroma-fibrin and a fibrillar or plasma-fibrin must be recognized, the former being identical with Weigert's coagulation-necrosis.

The conclusions drawn by Kemp regarding the relation of plaques to coagulation are: 1. When the blood is drawn the plaques break down almost immediately. This is not true of any other element of the blood. 2. The breaking down of the plaques is intimately connected, in times at least, with the clotting of the blood. 3. The connection between the breaking down of the plaques and the coagulation of the blood is not histological, but chemical—*i. e.*, the plaques appear to give up a soluble substance which is active in coagulation. 4. The active agent in question is most probably *fibrin-ferment.* 5. Fibrin is deposited histologically independent of any of the cellular elements of the blood. 6. When the clot is very scant fibrin is deposited as long, needle-shaped, crystal-like bodies.—Editorial from the *Journal of the American Medical Association.*

ORIGIN AND MICROSCOPICAL STRUCTURE OF COAL.

After a brief conversation at the tea-table, the host introduced the subject of the "Origin and Microscopical Structure of Coal." Two large "restoration pictures" or landscapes of the coal period showed in their living condition the peculiar plants and trees now found fossil in coal mines, being represented as luxuriating in the moist and swampy levels. Nearly the whole of the present area of the British Isles, with the exception of the northern half of Scotland, was shown as thus occupied. According to Sir Joseph Hooker, the climate was not subtropical, but moist and equable, like that of many islands of the Southern Hemisphere to-day. A companion map showed the very few spots in which the widely-deposited coal beds have survived the wasting atmospheric and other cosmical agents. Passing from the macroscopic to the microscopic, the speaker said that in the year 1870 Professor Huxley somewhat startled the scientific public by his memorable paper on the formation of coal, and his postulate that ordinary English and Scotch coal is made up chiefly of microscopic spores and spore cases, not unlike such as we see on the under surface of a bracken leaf. These minute organisms in their primary or de-

graded form made up the greater part of all the bituminous coals he had examined. The paper was a very valuable one for local purposes; but the attempt to get similar testimony elsewhere as to the construction of so world-wide a deposit as coal had failed so far as an application to Dr. Dawson, the author of "Acadian Geology," was concerned; while the recent and persistent European researches of Herr Reinsch, as told in his Micro-Palæophytologia, similarly showed the exceptional nature of Prof. Huxley's evidence. The spores in English coal were doubtless an example of the survival of the fittest in the coal forests, the amorphous ground substance or matrix in which they lay representing perished structures. A discussion followed.

Mr. E. T. Newton regretted that anything should be said even in apparent disparagement of Prof. Huxley's paper, which dealt with the data of its time in a masterly and truly scientific manner, and was a permanent contribution to our knowledge. It might seem astonishing that English coal should be so largely made up of spores, and people asked where could such an incredible deposit of these little organisms possibly come from, and what was the vegetation which yielded it. But the fact was incontrovertible; he could show his audience a 4ft. coal seam running for miles, and composed entirely of spores. No doubt, when the area of the coal forest was littered with the decaying vegetation, the more perishable tissues had been burnt up (oxydized) by aerial exposure, while the spores, with their resinous coats, had lasted long enough to be entombed and sealed up, not much the worse for wear, in the bed of the swamp. The purity of thick beds of coal told of the effectual "screening" exercised by the vegetation of the period, which filtered the currents charged with sand and mud. Leicestershire coal shows well both the "macrospores" and "microspores." Ordinary house coal (Newcastle) seldom shows them. In Silkstone (Wharncliffe) the brown parts are made up of microspores. Dalkeith coal shows both kinds of spores. The difference between dull and lustrous coal was often due to the abundance of spores in the latter. Mr. Newton concluded with some of his experiments in preparing coal for microscopic examination.

Mr. Slade, in some interesting details, followed Mr. Newton in ridiculing the advice to soak pieces of coal in bicarbonate of potash as a means of getting at their contents, and described his own process of cutting a section some $\frac{3}{8}$ inch in thickness, and then rubbing it down, as detailed by him some years since in Vol. II. of the Journal of the Queckett Microscopical Club.

The incidence of geological denudation, as illustrated by the fragmentary survival of the British coal deposits, was discussed at the instance of Mr. Stokes, the Hon. Secretary, the "great phantom of geological time" being invoked in explanation; zoological time in the same connection taking us back to the days of the labrynthodont and the earliest species of the still surviving duck billed mole.

Mr. Woodward pointed out that the nature of the spores in coal was first divined by the late Professor Morris.

The company then inspected, through the microscope, a valuable series of transparent slices of coal, the material being selected from British coal-fields, and rubbed down to the requisite thinness by Mr. Newton and Mr. Slade. Imbedded in the dull and nearly black ground-substance were seen the bright wine-red discs known as macrospores; the microspores were seen to be of the same bright color, but much smaller, Mr. Newton estimating them in one of his slides at an average of the seven-hundredth of an inch in diameter. For the most part they showed breaking up, and an increasing carbonization, but here and there the circular margin of the resinous coat was seen complete. Mr. Stokes showed two macrospores successfully extracted from coal. Mr. Wintour Gwinnell showed a beautiful suite of fossil stems, in which the highly decorative bark of lepidodendra, &c., were well seen, including a piece which he had rescued from the domestic coal-scuttle. The host showed pebbles, inclosing ferns of the period, a large section of a calamite, &c. At the next meeting Professor Stewart will deal with discoveries authorizing a new classification of the sponges.

EXAMINING IRON AND STEEL.—Mr. F. L. Garrison, writing in the Journal Franklin Institute, considers it is at present difficult to say what will be eventually the practical value of the microscope in the sciences of engineering. The *rôle* which it

seems most likely to play is that of an adjunct to the testing-machine, and not (as some have supposed) a rival to the chemical laboratory. That it will be a most valuable accessory seems, to say the least, highly probable.

As regards preparing the material for examination, the author points out that Mr. J. C. Bayles has described the process in such a plain and comprehensive manner that if his instructions are carefully followed, one need not encounter any serious obstacles after a little experience and the expenditure of a considerable amount of time and patience. Patience and cleanliness are the two most important attributes to be acquired by a student, if he desires success in a work of this character. A deficiency in either will be sure to spoil his work and in the end he will give it up in disgust, wondering what has been the cause of his failures. In grinding the specimens, it is quite unnecessary that they should be ground to an extreme thinness and mounted in Canada balsam, as microscopical objects are usually preserved. This entails a vast amount of labor to no end whatever. A good and accurate photograph, once obtained, is usually sufficient for any reference that may be desired in the future; besides, with a little care the etched surfaces of the objects can be preserved from rust by simply rubbing a few drops of kerosene oil over them with a soft chamois-skin, and then placing them in a tightly corked phial.

The size of the objects to be examined under the microscope may vary considerably; but the sizes found most convenient range from $\frac{1}{4}$ in. down to about 1-16 in. in thickness and from 1 in. to 1-5 in. in sectional area. If the specimens are extremely thin, there is often much difficulty in mounting them properly on a slide, and in getting the etched surface perfectly parallel to the object-glass. After the surface has been sufficiently treated with acid, and shows under the microscope no further traces of scratches made in the grinding, it should be carefully dried and cemented to a glass slide with wax or cement, great care being taken to have it in the proper plane parallel to the object-glass; otherwise, it will be impossible to make a satisfactory photograph.

The great difficulty encountered in pursuing the study of the structure of materials is that of making accurate and satis-

factory records of what is seen under the microscope. To effect this the only accurate and quick means is to photograph. Hence the student must not only be a good microscopist, but also understand the theory and practice of photography, an accomplishment which every engineer will find it useful to acquire."

Some limits are given for photographing and for selecting a microscope. The use of a condensing lense depends, it is said, upon the ability of the etched surface to reflect light. Thus hard steel reflects light so well that a condenser is not necessary, while in the case of pig, cast, or, wrought iron, its use is absolutely essential.—*Royal Microscopical Journal.*

ITEMS.

EELS IN VINEGAR.

WRITTEN BY GEO. ADAMS IN 1747.

Dr. Powers observes that if vinegar, in which these eels abound, be moderately heated, they will die, and sink to the bottom. But cold does not hurt them, for after such vinegar had been exposed a whole night to the severest frost, and was frozen and thawed and frozen again, and so several times over, they were as brisk as ever. He also tells us that he put some vinegar full of these eels into an essence glass and poured thereon about the same quantity of oil, which floating on the vinegar, all the eels would constantly creep up into the oil when the vinegar began to freeze, but when it thawed they as constantly returned to it again.

To furnish yourself with minute eels, always ready for the microscope, boil a little flour and water till it comes to the consistence of such paste as the bookbinders and shoemakers use; expose it to the air in an open vessel, and to prevent its hardening or becoming mouldy on the surface, beat it well together whenever you find it tends that way; after a few days it will turn sour, and then if it be examined with attention you will find thousands of those eels on the surface thereof. To preserve them all the year you need only to put a little water to them if the paste grows dry, or a supply of other paste,

always observing to keep the surface in a right condition, which will be easily done when it is once stored with these animalculæ. Their continual motion will prevent any mouldiness thereof.

They are very entertaining objects, but more particularly so if examined by the solar microscope, with which they may be magnified to an inch or more in diameter. The internal motion of their bowels may be very plainly seen, and their mouths to open to a considerable width.

MYCOLOGY OF ROME.—Two observers describe 116 micromycetes from the neighborhood of Rome, 98 of which are new to the district.

TRIP TO DEVIL'S LAKE.—On a botanical trip to Devil's Lake, Wis., a few weeks ago we observed on the sides of the cliff overlooking the lake immense numbers of the Columbine, Aquilegia Canadensis, and these were frequented by bumble-bees. One of the latter we watched as she passed from flower to flower gathering her load of sweets, and we observed that she invariably avoided the regular road to the nectar and sipped it through an opening in the base of the spur, which she either cut for herself, or which had been cut for her by a previous visitor. Our curiosity was awakened and as the flowers were very abundant many of them were examined, and it was found that the great majority of them had their nectaries perforated. We also watched the operation of perforating and ascertained that it was very quickly and easily done. We were aware that certain short tongued bumble bees were accustomed to obtain by illegitimate means the nectar from long-spurred or long-tubed flowers, but we confess the expertness of the thievery surprised us. Will the Columbines give up the struggle for existence and join the great host of plants that have been but no longer are, or will they develop some protective device to circumvent the bumble-bees?

ANATOMY OF LEAFLESS PLANTS.—Schube says that plants which have no or very few leaves are able to carry on the functions of assimilation by means of an unusually abundant development of the Parenchyma in the axial organs, and by a diminution of the means of transpiration.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

POLLEN and Vegetable slides double stained (new method) 50 cts. each. Slides and formulæ of new stains etc., 75 cts. each. A large variety of pollen, 5 cts. a package.
J. D. BECK, Liberty, (Tioga Co.) Pa.

WANTED—A Milliampermeter in exchange for cabinets, slides or cash.
CHAS. BLASDALE, M. D., Jericho, Queens Co., N. Y.

WANTED—Saville Kent's "Manual of Infusoria," bound or unbound, text with plates. Address with lowest cash price E. S. COUTANT, Des Moines, Ia.

WANTED—Microscope of modern make, Bausch & Lomb Investigator preferred. Also Forciminifera aud Polycistina. Will give fine slides or cash. E. H. RICHARDS, Woburn, Mass.

WANTED—Good Zentmayer Microscope Stand, Binocular preferred, none but a first class instrument. M. DE BALD, 136 Goodell St. Buffalo, N. Y.

FOR EXCHANGE.—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially esired. ROBT. W. WOOD, JR., Revere St., Jamaica Plain, Mass.

FOR EXCHANGE.—Mounted sections of injected lung of guinea pig.
CHAS. BLASDALE Jericho, Queens Co., N. Y.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

FRESH WATER ALGÆ, very numerous species, inclnding Volvox in abundance, Desmids of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M, ADAMS, Watertown, N. Y.

DIATOMACEOUS Earth from Denver, Colo., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Colo.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted. W. FARNELL, Macon, Ga.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7.50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M.D., 547 Clinton Avenue, Albany, N.Y.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. STILLSON, Indianapolis, Indiana.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium, having refractive index of 2.4, can be procured from H. H. CHASE, M. D., Geneva, N.Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for mounted specimens or material. H. W, WESTOVER, M. D., St. Joseph, Mo.

WANTED.—Unmounted material, any kind; foram-inifera and diatoms preferred; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

FOR EXCHANGE—Cathcart's ether freezing microtome, complete. Would prefer an injecting syringe. A. B. AUBERT, Orono, Penobscot Co., Maine.

WANTED—No. 5 of Vol. 2, and No. 1 of Vol. 3. This journal. Who can supply?
D. HUMPHREY, Lawrence, Mass.

FOR EXCHANGE—A new mechanical finger for a copy of Beale or Carpenter; slide of grouped diatoms for French objective, ¼ in. focus. HAROLD PLOWE, 136 High St., Peoria, Ill.

FOR EXCHANGE OR SALE--Wood sections, mounted or unmounted. Also few mounts of water-washed diatoms. H. M. RICHARDS, Sadsburyville, Pa.

WANTED—Micro-dictionary, 1 in. objective, accessories, rare diatoms, etc., for rare and ordinary slides. Please exchange lists. R. E. WOOD, St. Helena, Napa Co., Cal.

THE MICROSCOPE.

VOL. VI. DETROIT, SEPTEMBER, 1886. No. 9.

ORIGINAL COMMUNICATIONS.

THE HUMAN TOOTH.

C. H. STOWELL.

THE following is a brief description of the structure of an ordinary human tooth, together with some new drawings, from actual specimens, to illustrate the various parts.

A tooth may be said to be an enlarged papiela of the mouth, which has undergone such histological and chemical changes that it has acquired a remarkable degree of hardness.

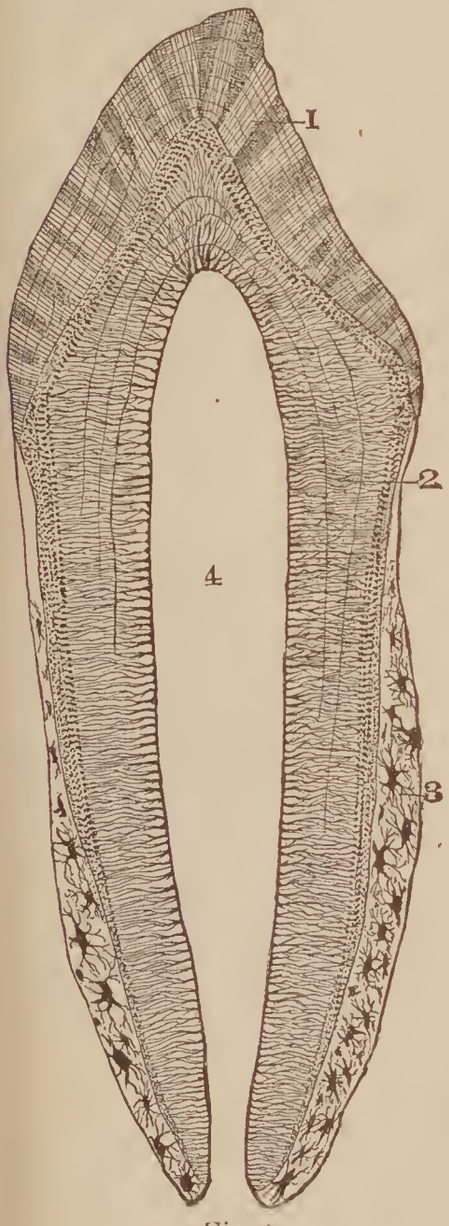


Fig. 1.

Figure 1 represents a vertical section of a human insisor tooth, magnified about twenty five diameters and reduced. All the parts are best seen if the specimen be mounted in hard balsam, after well-known methods. Surrounding the crown of the tooth is the enamel, 1, with its radial and concentric markings. This is the hardest substance of the body, and is composed of closely crowded polyhedral prisms. The dark, wavy, curved lines, running parallel to the surface of the dentine, are the *brown, parallel lines of Retzius.* Some authors attribute these lines to the presence of pigment, perhaps oxide of iron—while others, including the writer, believe they are due simply to inequalities in the density of the enamel prisms The radial markings, or the alternate light and dark bands, are due to the fact that the bundles of the enamel prisms are not all

arranged parallel, some standing vertical to the dentine and others nearly parallel with it; this crossing of the bundles producing the markings.

The *enamel prisms* are about $\frac{1}{7000}$ of an inch in diameter and are separated by a fine interstitial cement substance. The outline of the prisms, or rods, is not straight, but wavy. Hydrochloric acid causes them to break up into small cubic fragments of about equal size, these pieces correspond to the cross striations seen on the surface of rods isolated by means of some acid. Figure 2, A, shows the isolated fibres with their wavy outlines and cross striations; while B, of the same figure, shows the appearance of the rods in transverse section. In young teeth, this enamel is covered with a delicate membrane, *Nasmyth's membrane*, but in adult teeth it has disappeared, having been worn away.

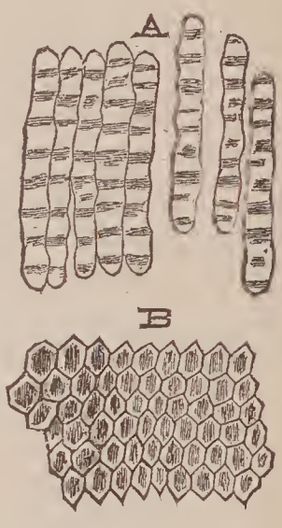


Fig. 2.

In the deeper parts of the enamel, near the dentine, there are longer or shorter canals between the bundles of prisms. These lead into the interglobular spaces of Czermak, described below.

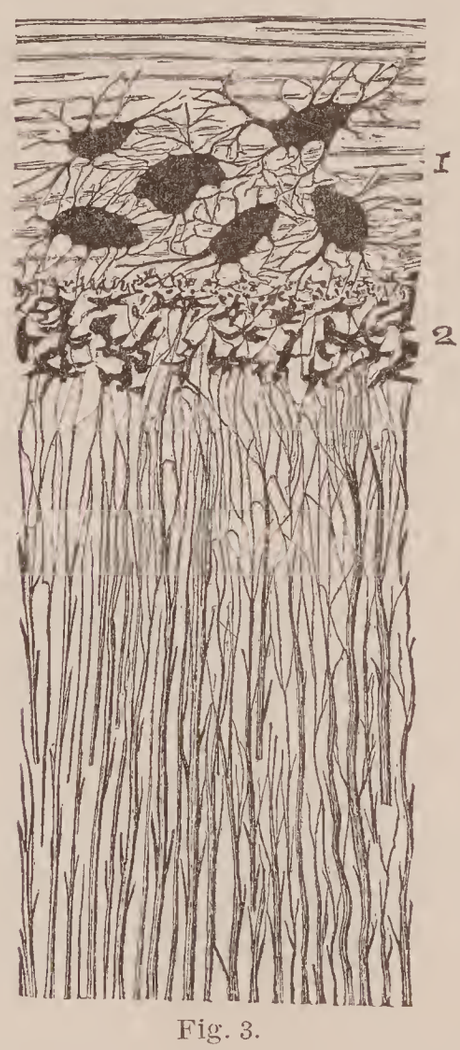


Fig. 3.

The *dentine* (Fig. 1, No. 2,) composes the great bulk of the hard part of the tooth. It has a firm matrix pierced with a number of minute canals, known as the *dentinal tubes*. These tubes are branched, commence at the pulp cavity, extend spirally outwards, become finer and finer, and finally terminate at the surface of the dentine, in larger or smaller cavities, known as the *interglobular spaces of Czermak*. These spaces contain branched, nucleated cells, not unlike those found in the lacunæ and canaliculi of bone. The dental tubes are lined with a sheath, *dentinal sheath*, and in these sheaths are the *dentinal fibres* of Tomes. The dentinal fibres appear to anastomose with the processes of the cells

found in the interglobular spaces. The parallel lines seen at 2, Fig. 1, are due to the simultaneous curving of a series of adjacent fibres; they are known as the *lines of Schreger*. The lower part of Fig. 3, shows the dentinal fibres as they appear when mouuted in hard balsam. They are seen to give off numerous anastomosing branches on their way to the interglobular spaces, represented at 2; while at 1, of the same figure, is shown the lacunæ and canaliculi of the cementum.

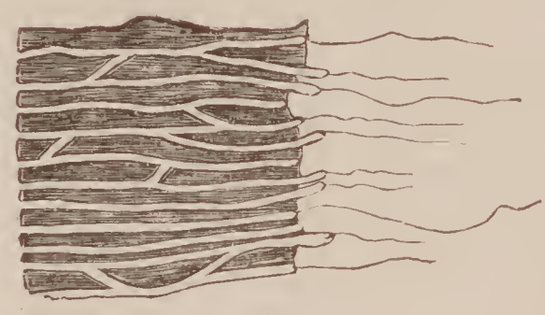


Fig. 4.

Fig. 4, shows the dentinal sheaths lining the tubes, an effect that can be produced by macerating young dentine in a ten per cent. solution of hydrochloric acid. Dr. Britton, of Detroit, whose specimens of teeth have excited the admiration of every appreciative beholder, has prepared teeth by using a seventy-five per cent. solution of caustic potash, with the result of making one believe that the dentine has a true laminated structure.

The *cement*, (Fig. 1, No. 3 and Fig. 3, No. 1,) is true bone matrix with lacunæ and canaliculi in which are the bone corpuscles. Haversian canals are not unfrequently found.

The *pulp* completely fills the central cavity, (Fig. 1, No. 4,) of the tooth. It is very vascular and contains numerous plexuses of nerve-fibres in a common matrix of connective tissue, in which is a net-work of branched cells. On the outer surface of the pulp, next the dentine, are two layers of cells. The outer layer is composed of oblong, columnar cells, known as the *odontoblasts*. These cells cling to the walls of the pulp cavity when the pulp is removed, giving the appearance of a distinct membrane, the *membrana eboris*. Between the deeper parts of the odontoblasts, and forming a distinct layer beneath them, are peculiar, branched, spindle-shaped, *nucleated cells*.

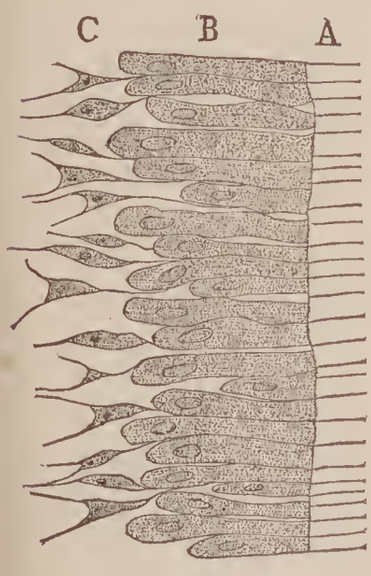


Fig. 5.

Fig. 5, illustrates these two varieties of cells. At "A" are the dentinal fibres; at "B" are the odontoblasts; while at "C" are the branched cells of the deeper layer. It is probable that the odontoblasts are con-

cerned solely in the production of the dentinal matrix, while the deeper cells, as seen at "C," send processes toward the dentine, whose canals they enter as the dentinal fibres.

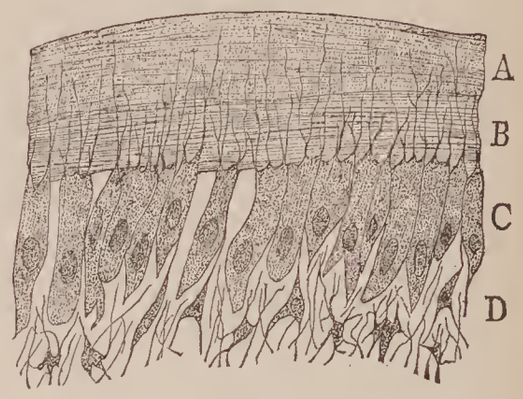


Fig. 6.

Fig. 6, represents a section obtained from a tooth of a young kitten. At "A" there is a layer of dentine quite hard from the deposition of lime salts. At "B" the matrix is much softer and but little calcareous matter is present. At "C" the layer of odontoblasts is well shown. Their processes extend into the newly-formed dentine, some reaching into the formed matrix. These processes remain in the dentine as it is forming, for the purpose, evidently, of making the dentinal tubes. At "D" are the cells of the deeper layer mentioned above. They are on the surface of the pulp as a distinct layer, although they do not differ from the numerous, branched cells found all through the pulp. Processes from these cells will extend into the tubes formed from the processes of the odontoblasts, as just mentioned.

Most of us are already sufficiently well posted in the histology of the teeth to know that *nerves are always present.* They form plexuses of non-medullated fibres on the surface of the pulp, and probably ascend into the dentinal canals with the processes from the deeper layer of cells.

Although apparently so easy to study, yet it is a fact that there are many questions concerning the structure of teeth very imperfectly understood. There is plenty of room and need for hard and faithful work in this line.

STAINING HUMAN SPERMATOZOU.

R. N. REYNOLDS.

WISHING to clean, stain and mount some slides of this most interesting material, I first sought something which would cause the fluid to mix with water; out of a large number of drugs tried, a weak aqueous solution of bichromate of potash was found to be the only one which, without destroying the objects, cause the fresh spermatic fluid to mix with water; but when the

fresh material is subjected to the action of the potash solution, the spermatozoa die with their tails coiled up. To prevent the coiling I allowed a specimen to die at the ordinary temperature of the atmosphere, which will usually take about thirty-five hours, though the weaker ones will drop off in five or six hours. By the time they all are dead, the specimen will be swarming with bacteria. To avoid bacteria, I placed a specimen in an ordinary ice-box, where I supposed they would die in less than an hour, but to my great astonishment they were as lively after being twenty-four hours on the ice as when first placed there, not one dead or motionless was to be seen. Replacing the specimen in the ice-box for another twenty-four hours, I found at the end of that time that some of the spermatozoa were dead, but still quite a large number were swimming about.

Later I bored a hole in a block of ice, and into this dropped a vial containing a specimen. I examined this once an hour for fifteen hours, with much the same result as obtained from the ice-box lot.

A specimen kept warm, but at a temperatuae something below that of the human body, died in about five hours, hence I concluded that cold water, used as a destructive agent, preserves the spermatozoa, but that moderately hot water would kill the most of them.

When mixed with water the spermatozoa may be stained any desirable color ; or by using red first, followed by green, the bodies appear red and the tails green. When the stains have taken effect, a plug of absorbent cotton may be placed in the neck of a funnel, and the specimen filtered through it. If the plug be tight enough, so that the water will not stream but only drop through it, thousands of the objects pass through, but tens of thousands remain in the cotton This plug is then taken out and the water squeezed from it. Place a slide on the turn table, dip an artists' small red sable brush into the fluid squeezed from the plug, and while the turn table is in motion bring the point of the brush to the center of the slide. A small round deposit will be left, which should be dried. Next with white zinc cement, make a ring of about half an inch in diameter on the slide, allow this to dry for a couple of days and then slightly moisten the ring with the same cement, lay on a cover glass, and you have a permanent mount.

THE MICROSCOPE.

A SONNET.

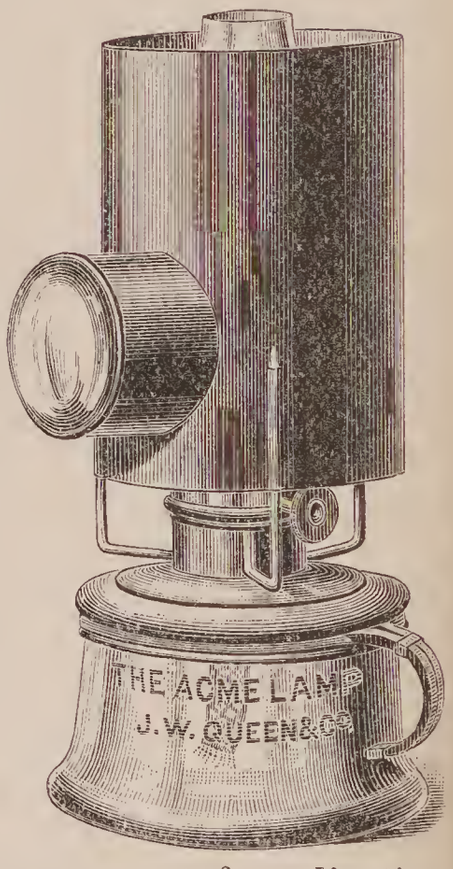
"Ut Natura dedit, sic omnis recta figura."

Before the Mountain's towering majesty,
The Sea, with its illimitable waves,
The tempest, roaring from its rocky caves,
We stand in awe of Power's supremacy,
And reverent bow before her Sovereignty.
But here, in thee, frail instrument, we hold
A more than fairy-fashioned key of gold,
That opes the boundless world Infinity;
And helps us trace, from its recondite source,
The first lace weavings of Life's dawning Now,
Down thro' its swiftly circling, onward course,
Till Man appears' with thought enshrouded brow;
And Science speaks, dazed by the mystic force,
Truly, God's own all piercing eye art Thou.

August, 1886.

NEW INVENTIONS.

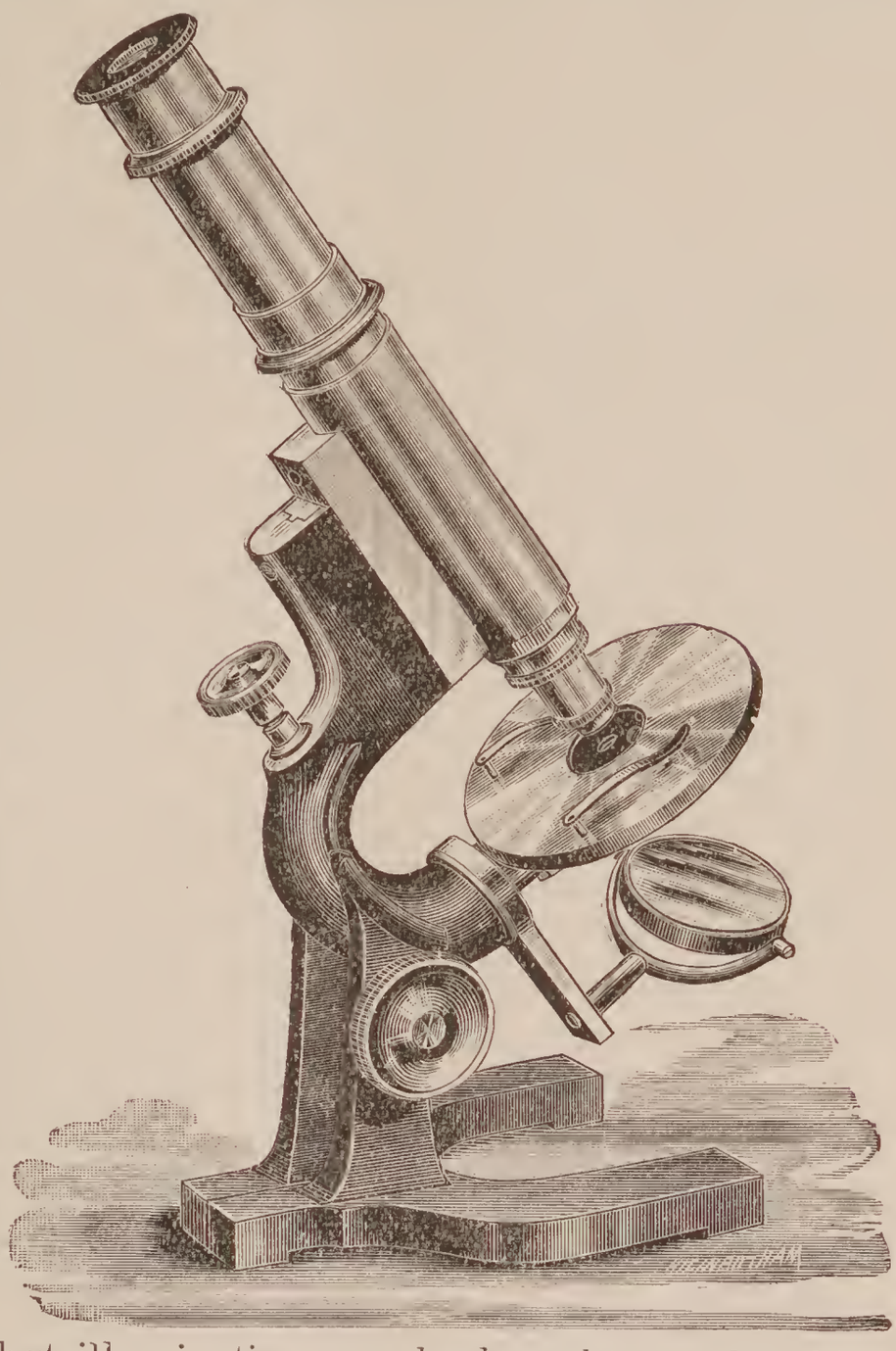
THE ACME LAMP.



WE have received from James W. Queen & Co., Philadelphia, a very useful lamp for microscopical purposes. It is quite simple in its construction, as the accompanying cut well shows. The shade which slides on three pins, thus allowing it to be adjusted at desired heights, is fitted with a bulls-eye lens. The beam of light produced by it, even with a small flame, is very powerful, quite sufficient for the use of a one-twelfth inch objective. The light is, of course, projected on the the ordinary substage condenser. We have tested the lamp carefully, and are delighted with it. We think, however, that it would be an improvement to substitute a bar and clamp for the present arrangement for adjusting the shade; otherwise it is quite perfect, being simple, effective and cheap.

NEW STUDENT MICROSCOPE.

THE BAUSCH AND LOMB OPTICAL CO. will soon put upon the market a new low-priced microscope for students. It is constructed on the principal of the concentric or rocking motion of the arm, by which the instrument becomes more firm the further it is inclined. It also has a new roller motion for the fine adjustment, the sliding-tube coarse adjustment, draw-tube and revolving diaphragm, fixed to a separate arm so that it can be swung out of the optical axis. The concave mirror is attached to a bar, the axis of which lies in the plane of the stage, so that illumination may be brought on the object from any point below or above the stage. The base and arm are japanned, the latter being fastened at any desired angle by means of milled heads in the pillars. Two special objectives,—a one inch 15° and ¼ inch 65°—the latter capable of resolving the lines on *P. Angulatum*, are furnished with the instrument at a very low price, putting it at once within the reach of students and amateurs.



THE PALMER SLIDE COMPANY OF GENEVA, N. Y., has sent us a number of their bevel-edged slides. Though not exactly a new invention, it may be well to again call the attention of our readers

to them. They are machine ground and of a quality of glass most beautiful to behold. They are not only useful for ordinary work, but are quite necessary to the æsthete who desires an artistic mount.

EDITORIAL.

THE CHAUTAUQUA MEETING.

WHEN it was first proposed to hold the meeting of the American Society of Microscopists for 1886, at Chautauqua, misgivings arose in the minds of some as to the advisibility of selecting such a place for a four days microscopical reunion.

And there was reason in this, for while each member who attends a meeting takes a lively interest in the society's work, yet in a place like Chautauqua there areso many and varied outside attractions, it was hardly to be supposed, that members would give all their time listening to papers which could afterwards be read in the Transactions.

Our good friend, Mr. E. H. Griffith, with his usual thoughful foresight, became not a little anxious too, lest his working session should be crowded into some obscure corner, and the "*Soiree*" consigned to the grove, where worms and insects would distract the observer and turn the exhibition into an entomological display.

None of these interesting departures occurred however, the meeting was in every sense of the word a success, reflecting great credit on all who where connected with its management.

The kindly reception also given by the Chautauqua authorities should not be forgotten.

If, as the *Herald* says, "the presence of the microscopists marks an era in the history of the Lake," the visit to this beautiful place will ever be a bright memory to all who where fortunate enough to be present at this meeting.

WE clip the following personals from *The Chautauqua Herald's* "Walks and talks in the Grove:"

"I found ex-Governor J. D. Cox, of Ohio, yesterday, during the working session of the microscopists, surrounded by the men of the yellow badge and evidently deeply interested in the work of the meeting. From his unassuming appearance and modest bear-

ing you would not suspect the high honors he has borne, both of state and on the field. One of the members told me 'He is one of our most active workers and has invented a microscopical instrument of rare qualities and great value.' I asked the general about his present work and he replied, 'I have been for several years Dean of the Cincinnati Law School, and at present am also president of the Cincinnati University. This institution is free to all the youth of Cincinnati, and is having a liberal patronage.'"

"Dr. S. W. Dennis has come all the way from San Francisco, Cal., to attend the microscopists' meeting. He is one of the organizers of the American Society. I inquired about the University of California, with which he is connected, and he said: 'It was established about twenty years ago, is richly endowed and has about four hundred students. California is a growing state, and education is gaining in public interest. The present line of development in the state is not mineral but agricultural. We are receiving immigrants from all parts of the world. The population is very heterogenious.' I asked the Doctor about the Chinese. 'The Chinaman is bright, frugal, industrious, but he dosn't civilize or Christianize very rapidly. It is a great injustice to suppose, as some appear to, that the people of California are turbulent. I think that under their circumstances they are the most forbearing people on the face of the earth.'"

"I was introduced to Dr. Thomas Taylor, Microscopist of the United States Agricultural Department, at Washington, D. C. It is his work to investigate everything of microscopial character for the farmers, fruit-growers and dairymen of the country. He said to me: 'My work lately has been to detect the presence of foreign fats and butter substitutes. I made such investigations for the Washington police and other authorities. We recently convicted seven persons, each of them acknowledging in open court the selling of tallow compounds for butter, and we have driven out of the business many persons who were selling oleomargarine for the genuine butter.'"

The Herald also truly remarks that the presence of the A. S. M., "marks an era in the history of Chautauqua Lake."

IN an editorial on the "Advance of Pathological Photography," the *British Medical Journal* says that a perfect system of rep-

resenting pathological specimens, as seen under the microscope, by photography, is much to be desired and it seems that such a system will very shortly be perfected."—The photo-micrographs of pathological sections which we have seen in this country have not, as a rule, been successful,—but we see no reason why, with properly prepared specimens, pathological objects should be more difficult to photograph than normal objects, etc.

THE work done at the working session of the A. S. M. this year was never excelled. At the forty tables, nearly every department of microscopy was demonstrated. This feature of our meetings is of great practical importance to microscopists, and the results are already becoming evident.

PROF. BURRILL'S address before the American Society of Microscopists is the ablest summary of bacterology that we have ever met with. Our abstract will run through several numbers of THE MICROSCOPE, and we trust that our readers will give it careful perusal.

ABSTRACTS.

BACTERIA AND DISEASE.

Abstract of the Annual address delivered Aug. 10th., before the American Society of Microscopists, by T. J. Burrill, Ph.D., President.

Fellow members of the American Society of Microscopists:

I am to address you to-night upon a class of living things of whose very existence nothing was known nor could have been known except by the aid of the microscope. Since the latter, though now perhaps the most nearly perfect instrument of man's mechanism, is of recent origin, the minute organisms of which we speak are new to human knowledge. In fact no considerable attention was paid to them until within the memory of the majority of the members of our society, about thirty-five years ago. The classic researches of Schwann, of De la Tour, of Pouchet and especially of Pasteur, upon fermentation and spontaneous germination at length, caused careful studies to be made upon these, the least in size of nature's animated existences. Then the observed

evidences that the bacteria held some relation to disease, (first seriously suspected in the case of anthrax or splenic fever in cattle, afterwards demonstrated to be the cause of this dangerous malady by Pasteur and Koch), brought them prominently into notice. Now, for twenty years the literature upon the nature and effects of bacteria has been steadily growing, until to-day it is scarcely possible for any one man to keep track of the voluminous pages devoted to them. It is to these organisms that I now invite your attention.

* * * * * * *

First, what are bacteria? Nothing need here be said as to their appearance, structure, or place in a classification of natural objects, but we may especially ask whence their origin? It is certainly important in our discussion of the origin and occurrence and recurrence of disease that we should understand as fully as possible all the circumstances and conditions connected with the disease agents. Let it be taken as scientifically settled that living organisms do not spontaneously come into existence through some transformation of inorganic materials. We need not say that this never has occurred, nor in fact, that it may not, under some peculiar circumstances or conditions, be true now, but evidence is so abundant that this process does not take place in the usual course of affairs, that we may exclude it altogether in our practical relations with the objects. We have then only to ask, are the bacteria independent, autonomous existences, or are they temporary modifications of other living things. It has been held by competent observers, that in certain conditions, various species of fungi become so modified in their growth as to assume, temporarily, the form in which we observe them as bacteria. Various accounts have been given in scientific publications, of the observations upon such changes. These, however, are mostly by men not especially familiar with the actual developments of the organisms in question. We positively know that some of these assertions are untrue, for when less fallible means are employed in experiments of the same kind, other results are uniformly obtained. By many, however, the idea is not entirely abandoned. During the last year in a reputable scientific publication in France, a series of articles, based upon elaborate and extensive experiments and observations, have appeared, in which the author endeavors to show that the so-called

microbes (bacteria) are nothing more than vegative states of a common mould (penicillium). In a similar way, but with apparently more reason, a well-known German investigator announces the derivation of yeast plants (allied to bacteria) from the smut fungi (Ustilagineæ).

Recently a paper has appeared in our own country in which the author, upon theoretical grounds, concludes that bacteria owe their origin to the metamorphosed tissues of animals, a view previously put forth. A sharp discussion occurred two months since in the French Academy of Medicine, between Pasteur and Bechamp, the latter holding the ground that microbes of the various genera and species are transformed somethings which he calls microzymas. These latter, according to Bechamp, are definite associations of chemical molecules, existing from the creation of matter, and capable under proper conditions of becoming transformed into low and simple forms manifestly endowed with life and its activities. It is not the older ideas of spontaneous generation, for the microzymas and special organizations already possessing the power and potency of life, but quiescent or latent. In the open meeting Pasteur combatted Bechamp's results, the hot discussion reminding one of several similar ones in which it will be remembered the former distinguished contestant came off victorious.

But a commission has been appointed to examine into the matter of Bechamp's microzymas and we shall before long know the opinion of the examiners.

We have nothing to say against such speculation, even when founded upon hypothetical deductions; but must continually ask ourselves what is the evidence of experiment? If this seems to teach now this, now that, in a question of this kind let us re-examine our methods, resting assured that error lurks somewhere.

It is wonderful how convincing the recent methods of pure, uncontaminated culture of the lowest and simplest organisms have become. One may easily aquaint himself with these processes, and without much apparatus besides his microscope, may soon form an opinion for himself, as to whether bacteria ever arise from anything besides pre-existing parent forms, each after his kind in foreordained succession as immutable as in the case of oaks or of horses. This, of course, does not exclude some difference in size, form and method of growth on account of difference in conditions.

Who has not seen submerged leaves on plants dissected into feathery divisions, while the æriel ones on the same stems arising above the water are entire or slightly lobed? Any one agriculturally observant, who has traveled through New England and the states of the Mississippi valley, must have noticed the difference in the size and appearance of maize or Indian corn—in the latter two to four times the height seen in the former regions. Nature everywhere is prodigal in variety of form, size and appearance.

We must expect something of the same thing among our microscopic growths; but, allowing for this, the concurren testimony of the best and most expert investigators now is that bacteria are true and distinct existences, having real genera and species, propagated like other living things from individuals to individuals—if we cannot so properly say—owing to their method of simple division, one into two, two into four, etc.—from parent to offspring.

Secondly, do bacteria cause disease? Admitting the existence of bacteria, and the perpetuity of their specific forms, the proof that they have anything to do with the cause of disease is constantly challenged. It would almost seem that men are determined not to accept proof in this case, however strong it may be. Large numbers of the medical profession appear to pride themselves upon not accepting "new fangled ideas," whatever the basis of evidence. Quote your authority to them on this matter of parasitism and the sufficient reply is, "O, he is a bacteria crank!"

Now, I have profound respect for the profession of medicine and for the men who laboriously and conscientiously practice the healing art, whether they accept any special ideas held by myself or not; but I respectfully submit that one who personally and experimently know nothing upon a given and particular subject, no matter what may be his information upon other matters, or how broad his knowledge or great his fame, is not a competent judge upon the special thing of which he is confessedly ignorant.

Certainly too many medical men, as well as others, have not recognized this apparently axiomatic truth. Witness the discussion upon the etiology of disease in the meeting of the American Medical Association, at St. Louis, in May, 1886. The "microscopic bugs," according to one speaker, had received of late altogether too much credit as causes of disease! It is ever thus. Old ideas die hard. We hear a good deal, fortunately not so much as

formerly, about the conflict of science and religion, and we cannot disguise the fact that there is a conflict, deep and earnest, ofttimes sore; but it is a conflict again between the new and the old—not of truth or about truth, but of men's changed ideas of truth.

Among those whose business it is to deal with the therapeutics of disease, we find more and more of the younger men intelligently accepting the bacterial etiology of disease.

By the time that these become in general, as they now are in hopeful part, the professors in the colleges, students will have no further hesitation in believing their senses and in adopting the testimony of trustworthy experts.

It would carry me too far to attempt to detail here, even for a single case, the convincing and indisputable proofs that bacteria do cause disease, neither is it necessary in this presence, for among those whose inclinations and opportunities have lead to the satisfying use of the microscope, and to the examination of the abundant literature connected therewith, there is no doubt upon the subject, there is no need of a repetition of the evidence.

(To be continued.)

TRACKS OF INSECTS SIMULATING VEGETABLE IMPRESSION.—Zeiller has found impressions in the Oxford clay at Villers sur-mer,—which are hardly distinguishable from those of plants,—but which have undoubtedly been made by insects. These insects must have made galleries in the soil 0.015 m. in diameter, and 0,005 m. deep parallel to the surface and branching repeatedly in a series of galleries, which lead off from the main gallery alternately to the right and left at an acute angle. The insect producing these was probably a mole-cricket, *Gryllotalpa vulgaris;* the resemblance is remarkably close to the undoubted impression of conifers belonging to the genus *Brachyphyllum.—Jr. R. M. Society.*

STERILIZING FLUIDS FOR HYPODERMIC USE.— According to the *Therapeutic Gazette*, the sterilization of fluids for hypodermic injections has been investigated by two observers, independently of each other. These are M. Limousin, of Paris, and Dr. Friedlander, of Berlin; the process used in each case being similar, i. e. the fluids are placed in little glass balloons having an elongated neck, (similar we should imagine from the description to the small glass pearls of nitrite of amyl,) which are heated and sealed in the oxyhydrogen flame. When employed, the neck of the balloon is broken, and

syringe point inserted. By Friedlander's method, which is a little more complicated than the other, the fluid is absolutely freed from septic germs and can be kept indefinitely. Different colored glass is used to indicate the nature of the drug enclosed, as red, for morphine, etc., etc.

FORCE OF GROWING PLANTS.—The force exerted by growing plants is very great. Fungi are composed of soft tissues, yet a growing mushroom has been known to lift a large paving stone. The rootlets of pines and cedars growing on the sides of rocky declivities penetrate narrow crevices in the rocks, and finally by their growth loosen huge masses and send them tumbling down the cliff Years ago President Clarke, of the Massachusetts Agricultural College, put a pumpkin into harness and demonstrated that it was capable of lifting thousands of pounds. In a cemetery in Hanover a seed germinated in a crevice beside a tombstone which contained twenty cubic feet. The seedling, now a small tree, has lifted the stone over five inches. Not the least wonderful of phenomena of this class is the force exerted by the radicle of the germinating plant. Darwin has demonstrated that it exerts a force, which in proportion to its size, is astonishing This force the plantlet utilizes in sending its root into the soil, and the strangest part of the strange phenomena is that the little soft radicle is capable of penetrating soil very much harder than itself.

ANT-PLANTS OF THE INDO-MALAYAN ARCHIPELAGO AND NEW GUINEA—Dr. O. Beccari gives a summary of what is at present known respecting this remarkable group of plants, in which ants take up their residence in special chambers in the tissue, and plant and animal seem each necessary to the life of the other. A good example is furnished by *Acacia cornigera*, and its connection with a particular species of ant, *Pseudornyma bicolor*, which makes its nest in the strong bifurcated spines of the stems and branches, after perforating them near their apex. They devour the pulpy interior of the spine, and then find nutriment in the saccharine and nutritive substance in the glandular structures of the young leaves. Here they remain always on the alert, forming an army of defence against herbivorous animals and other species of ants which would destroy the leaves. If cultivated where these friendly ants cannot gain access to it, the plant appears to perish. Another exceedingly

good illustration of these formigerous plants is *Myrmecodia*, an epiphytic genus of Rubiacæ, and others are found scattered through the orders Myristicaceæ, Euphorbiaceæ, Verbenaceæ, Melastomaceæ, and Palmæ.

Dr. Beccari explains the phenomenon on the basis of variability and heredity. When a seed of *Myrmecodia* falls on the branch of a tree and germinates, a small swelling makes its appearance on the tigellum, serving the purpose of a reservoir of water for the plant during the dry season, but never attaining any great development without the intervention of ants. When these visit it for the sake of food, they cause a hypertrophy of the cellular tissue similar to that of galls; and this individual peculiarity is transmitted to the descendants until it becomes fixed by heredity. These phenomena occur in many species of *Myrmecodia* and *Hydnophytum.—Jour Royal Mic. Soc.*

INVESTIGATION WITH THE MICROSCOPE.—Under the above title Dr. H. G. Gabel presents an interesting and instructive paper (*Chicago Med. Times.*),—in which he calls the attention of the profession to the great service which the microscope is rendering in the field of medicine. He also offers several pleasant bits of advice and practical suggestions.

"Before attempting any original investigation," he says, "the operator should instruct himself in every part of microscopic work and should examine the same object in many different ways, and under different conditions. The experience thus gained will be of the greatest importance to him in special investigation, his eye and mental faculty will be subjected to careful training, which alone will render success possible and avoid the most unfortunate mistakes. The microscope affords the most refined and elevated kind of pleasure by the exhibition of objects of extreme beauty and interest,—as the display of some objects under polarized light, and the brilliant scales of some insects when viewed as opaque objects by means of a good condenser, surpass anything known to us in our daily experience. There is not a mote that dances in the sunbeam, nor a particle of dust that we tread beneath our feet, but contains mines of knowledge yet unworked. The microscope is the key that unlocks a world of wonders and beauty before invisible, which, one who has once gazed upon it can never forget and never cease to admire. But as an instrument of research the microscope

now occupies a position which is second to none. The student in every department of science must now be familiar with the microscope. Truly did Schleiden, a most successful investigator, say: "He who expects to become a botanist or a geologist without using the microscope, is, to say the least of him, as great a fool as he who wishes to study the heavens without a telescope."

THE USE OF THE CAMERA LUCIDA.—In most cases when a microscopic image is to be traced, recourse will be had to some camera lucida. The use of this very helpful apparatus is very soon and very easily learned. There is therefore need of saying but very few words about it

The eye should be held close to the opening, provided for seeing in the instrument and look perpendicularly down, for by looking obliquely the image may be considerably distorted. The paper upon which the drawing is to be made should be fastened lying flat at a standard distance of 25.4 cm. from the camera lucida. It is best to provide a drawing board upon which the paper may be fastened and which may be placed at this distance from the camera.

In order to draw a picture by means of the camera lucida without painfully straining the eyes, it is necessary that the microscopic image, and the paper and pencil be uniformly illuminated. If the image has, in comparison with the paper too strong a light the pencil will be seen with difficulty if at all. On the contrary, if the paper in comparison to the image be too strongly illuminated, the delicate outlines of the latter will be indistinct. The first usually occurs where the image of the paper and pencil is thrown into the field of view of the microscope and the latter when the microscopic image is reflected upon the paper. This difficulty may be remedied by throwing either the image or the paper into a shadow. Both may be done simply with the hand, or by a properly constructed screen of paper, or by a disk of pasteboard set up at some distance, and the like. A few trials with the microscope with different magnifications will afford the necessary experience for properly managing the light. In tracing the outlines of the image under the camera, the pencil used should not be too hard and the lines should be very light, and then they will afterward appear rough, for the position one has to take in this work is not very favorable to nice drawing.—*Behrens.*

NEWS AND NOTES.

WANTED.—No. 1, Vol. I, of THE MICROSCOPE. Fifty cents paid.

DR. TAYLOR made an able reply to Prof. Webster's objections at the A. S. M. meeting at Chautauqua.

PROF. VIRCHOW recently completed the thirtieth year of his occupancy of the chair of Pathological Anatomy in Berlin.

FRESH water lavae may be mounted in balsam, after having been thoroughly drained and then soaked for a month in clove oil.

AT the recent meeting of the A. S. M. held at Chautauqua, nearly every state in the Union was represented by an "active" member.

WE shall publish a full report of the Chautauqua meeting of the American Society of Microscopists next month. The manuscript arrived too late for insertion in this issue.

PROF. WILLIAM A. ROGERS, A. M., F. R. M. S , of the Harvard (Cambridge) Observatory, and the highest living authority on micrometry in the world, has been chosen to fill the chair of Physics at Colby University, Waterville, Me.

TUBERCLE bacilli have been demonstrated in the large numbers in the supra-renal capsules in Addison's disease. This discovery goes to prove what has long been held by some writers that the lesion in this disease is a local tuberculosis.

A. ANDREE claims that leaves transpire, not only water, but soluable salts, which have become superfluous for their vital process; and that this takes place especially through the water pores The chlorides of magnesium and sodium were found to be excreted in that way.

DR. FRITZ MUELLER reports in *Kosmos*, an unique instance of an epiphytic orchid Aëranthus, which, though only consisting of roots and heads of small flowers, nourishes itself independently, since the long, much coiled roots contain chlorophyll, and thus act as leaves.

DR. N. TRINKLER adds *chlorophyll* to the already long list of vegetable stains. It is obtained from the leaves of the *Syringa vulgaris* by extracting for twenty-four hours with alcohol, evaporating the filtered extract to dryness and dissolving in water. The filtrate is a dark green with a trace of brown in it.

PROF. S. BUTSCHLI, (*Morph. Jahrb. X. 1885*) preserves Cilioflagellata in picro-sulphuric acid, afterwards changing to alcohol. By this means the flagella are extremely well retained. The posterior flagellum was well observed after the action of osmic acid vapor; but a one per cent. solution caused it to disappear.

PROFESSOR HEINRICH FISCHER, of the University of Freiburg, in Baden, who died last February, was a diligent student of microscopical minerology, and distinguished himself by his investigations on the origin and character of jade, concerning which he published, in 1875, the book, "Nephrite and Jade."—*Popular Science Monthly.*

PASTEUR remarks in the course of his address that although his laboratory had for the past five years been devoted to the study of rabies, and had become, as it were, the center of all information and observation pertaining to this affection, he shared the universal surprise in finding how large the number of persons bitten by mad dogs actually was.

AS A special criterion of tubercle bacilli, Dr. Voltolini states that if cover preparations of phthisical sputum be laid in strong nitric acid (1.45—1.50 sp. gr.) before staining with the Ehrlich solution, the bacilli are afterwards found to have a granular moniliform appearance. The author considers this a special characteristic of tubercle-bacilli, as he has not found it in any other microorganism, not even in the Lepra-bacillus.

TO SHOW the intercellular substances in the vicinity of the nuclei of Schwann's sheath, Dr. A. Gruenhagen teases out the nervous ischiadicus of the frog; then pours over the preparation for two or three minutes some drops of a half per cent. solution of silver nitrate. He then washes in H^2O, dehydrates in absolute alcohol, stains with concentrated haematoxylin, dehydrates again, and mounts in balsam.—*Jr. Royal. Mic. Soc.*

TARTAR found upon the teeth is composed chiefly of earthly phosphates and carbonates, with which is mingled a certain proportion of organic matter, epithetial scales, fatty particles, filiform fungi, vibrios and monas. According to Mr. Bland Sutton, accumulations of tartar occur on the teeth of monkeys, kangaroos and lemurs, at the garden of the Zoological Society, London, and is an occasional cause of death from septic pneumonia.—*Archives of Dentistry.*

MR. J. H. LONG, in a recent paper on the microscopic examination of butter, arrives at the conclusions, that, "taking all things into consideration, we have no absolutely certain method of distinguishing between butter and some of its substitutes, and that of all methods proposed, the microscopic are, perhaps, the least reliable." These conclusions are similar to the ones reached by Prof. H. A. Webster, but are directly opposed to those of Dr. Taylor.—*Science.*

DR. RIBBERT finds the following method in staining Pneumonia-cocci for cover-glass preparations excellent: 100 parts water; 50 parts absolute alcohol; 12 per cent. glacial acetic acid, dalia to saturation. The covers are only just touched with the material, washed in water, and examined. Mounted in glycerine or balsam, the cocci appear a deep blue, while the capsules are a pale blue. The stain does not last longer than a few months. It is unsuitable for sections.

THE officers for the coming year of the American Society of Microscopists are, President, Wm. A. Rogers, Waterville, Me.; Vice-Presidents, C. M. Vorce, Cleveland, O. and Dr. Jas. E. Reeves, Wheeling, W. Va.; Secretary, D. S. Kellicott, Buffalo, N. Y.; Assistant Secretary, Dr. S. M. Mosgrove, Urbana, O.; Treasurer, Dr. Geo. E. Fell, Buffalo, N. Y.; Members of the Executive Committee, J. J. B. Hatfield, Indianapolis, Ind., Dr. W. R. Mandeville, New Orleans, La., Dr. W. A. Clapp, New Albany, Ind. The place and time of meeting (1887) to be determined by the Executive Committee.

"G. R.," in the *Scientific Enquirer*, recommends Gum Tragacanth as the best material for sticking labels to glass. It is prepared as follows: Select three or four pieces of the gum, about the size of a coffee berry, and place in a two ounce wide-mouthed bottle; then pour over it acetic acid so as to hardly cover the gum, and place the bottle aside until the next day, by which time the gum will have absorbed the fluid and become very much swollen. Now add water, stir well, and in a day or two a semi-transparent jelly will be the result. A drop or two of pure carbolic acid should be added, and it will keep indefinitely.

THE Spanish government has recently decided to establish a "Maritime station for experimental zoology and botany," to be in charge of a director, one assistant and two fellows, all salaried. It

is to be opened to students from all parts of the world, the results of all investigations to be published by the department of public works. In addition to the salaries of the officers, two thousand dollars annually will be appropriated for its support. The site has not yet been fixed upon, and *Cronica Cientifica* justly complains of the inadequate provisions made for its establishment and support. Spain is almost the last of the chief civilized nations to found a zoological station.—*Science.*

H. R. BOULT, gives the following directions for mounting bird parasites: My usual plan is to catch them alive, if possible, (with a needle dipped in turpentine), and immediately put them into a bottle of turps. When they have been soaked a few hours for the small ones and longer for the larger ones, lift them out with a tube, and deposit a drop of turps on the slide with two or three parasites in it. Arrange with a needle, and then, taking a small quantity of balsam on a needle, touch the slide near the objects, draw a thread of balsam across and around them, then put aside for the turps to evaporate. Afterwards a drop more balsam and a cover will settle that slide —*Journal of Microscopy.*

FOR COUNTING WHITE BLOOD CORPUSCLES, M. J. Toison adopted the staining method, using the basic anilines, of which he found methyl-violet 5 B the most reliable. The formula given is :—Distilled water, 160 c. c m.; soda sulphate, 8 grms.: methyl violet 5 B, 0.025 grams. The violet was dissolved in the glycerine, diluted with half the distilled water, the salts in the other half: the two mixed and filtered when cool. The staining fluid was mixed with the blood and then placed in a cell or moist chamber. The staining action is well marked in from 5 to 10 minutes, and attains its maximum in 20 to 30 minutes. The white blood-corpuscles appear as small granular violet balls, which are easily distinguished from the greenish red corpuscles—*Jr. Royal Mic. Soc.*

PROF. FORBES publishes in the "Bulletin of the Illinois State Laboratory of Natural History," vol. ii., pp. 257–321, an account of the continuation of the interesting studies on the contageous diseases of insects, begun by him in 1883. In this account he describes at length a highly distinctive disease of the English cabbage-worm, (*Pieris rapae*). This disease he believes to be caused by a spherical microscoccu, of which he gives two excellent micropho-

tographs. More complete and conclusive studies were made of a disease of the silk-worm, which was apparently that known as jaundice. Of especial interest is the fact that he was able to produce this disease in cabbage-worms by moistening their food with culture-fluids containing the bacteria of this disease derived from silk-worms. These experiments seem to us to be of the highest importance. If this or some other bacterium could be used against the cotton-worm, how much more effectual it might be than the poisons which are now used. These are liable to be washed away by the first rain and will not multiply themselves. Prof. Forbes also reports at length on a disease attacking two species of datana in his breeding cages. This disease he is positive is the well-known *flacherie* of the silk-worm.—*Science.*

BOOK REVIEWS.

TRANSACTIONS OF THE MICHIGAN STATE MEDICAL SOCIETY—TWENTY-FIRST ANNUAL MEETING.—We have in the present volume a work creditable to the society it represents, and their committee on publication.

The arrangement of the contents is convenient, and especially satisfactory is the plan of placing the discussion immediately after the paper to which it relates. A matter for regret is that discussion of papers is not more general. The discussion is often of more value than the paper itself. The typographical execution and proof reading of the transactions are beyond criticism. A.

PUBLISHERS' NOTICE.

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CORRESPONDENCE AND QUERIES.

LIBERTY, PA., September 30, 1886.

Editor, Microscope.

There is one great objection to high power objectives—from one-sixth inch to one-fiftieth inch *i. e.* the extremely short working distance between objectives and cover glass. I am no expert in optics, but I do firmly believe that the form, the construction, the arrangement and combination of lenses for objectives can be modified so as to give a working distance between the objective lense and cover glass of one-fourth inch for a one sixth objective and one-thirty-second inch for one-fiftieth inch objective. I may be looked on with apparently good reason as a crank for entering the field so boldly with such an idea. Things have been accomplished (successfully) apparently as difficult as this enthusiastic idea of mine. For example high angles of aperture of objectives. It appears that ninety degrees was at one time considered the highest limit of angle of aperture for objectives, and the man who predicted it possible to construct an objective with an angle of one hundred and eighty degrees aperture certainly would have been called a crank, but it has been successfully accomplished "just the same." How much higher the angle can be applied to objectives I do not know. It may be the limit. Is it not possible or even probable that the working distance may be increased to the limit mentioned? It would permit the use of thicker cover glasses which might be from one-fiftieth to one-thirty-second inch thick—a great desideratum for dry mounts on which thin cover glasses are so easily broken,—nearly an inevitable fact. For balsam mounts thin cover glasses answer tolerably well, having a solid support over the entire surface. How cover glasses one-thirty second inch thick would act on balsam, I don't know, or whether the unequal shrinking of balsam would crack them. I think they would spring that much before cracking.

Thick covers could be cleaned without the common occurrence of breaking them while wiping them clean. A mount being one-thirty-second inch higher, owing to a thick cover glass, would be no serious objection so long as there is sufficient room in the world for slides. The frequent breakage of thin slides and thin covers is an annoyance which far overbalances the convenience claimed in the saving of space in storage or weight in mailing them. Another great advantage gained in objectives of such working distance mentioned, it would to a great extent lessen the danger of scratching, injuring or soiling the object lense of high power objectives. I hope opticians will make an effort in this direction.

J. D. BECK.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

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WANTED—A Milliampermeter in exchange for cabinets. slides or cash.
CHAS. BLASDALE, M. D,. Jericho, Queens Co., N. Y.

SLIDES, labels for same and material in exchange for slides.
EUGENE PICKNEY, Dixon, Ill.

WANTED—Microscope of modern make, Bausch & Lomb Investigator preferred. Also Forciminifera Polycistina. Will give fine slides or cash.
E. H. RICHARDS, Woburn, Mass.

WANTED—Good Zentmayer Microscope Stand, Binocular preferred, none but a first class instrument. M. DE BALD, 136 Goodell St., Buffalo, N. Y.

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H. B. CHAMBERLIN, box 1597, Denver, Col.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds ; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted.
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AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium having refractive index of 2, 4, can be procured from H. H. CHASE, Geneva, N. Y

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

PATHOLOGICAL, Histological and Miscellaneous Mounts, will be exchanged for material. H. W. WESTOVER, M. D,. St. Joseph, Mo.

WANTED.—Unmounted material of any kind ; foraminifera and diatoms preferred ; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

FOR EXCHANGE—Cathcart's ether freezing microtome. complete. Would prefer an injecting syringe. A. B. AUBERT, Orono, Penobscot Co , Maine.

WANTED—No. 5 of Vol 2, and No. 1 of Vol. 3. This journal. Who can supply ?
D. HUMPHREY. Lawrence, Mass.

FOR EXCHANGE—A new mechanical finger for a copy of Beale or Carpenter ; slide of grouped diatoms for French objective, ¼ inch in focus.
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FOR EXCHANGE OR SALE—Wood sections, mounted or unmounted. Also few mounts of water-washed diatoms. H. M. RICHARDS, Sadsburyville, Pa.

WANTED—Complete or partial set of Woodward's photo-micrographs ; also to exchange, photo-micrographs of various objects ; a list of which will be sent on application JAS. B. SHEARER, Cor. Center & Adams Sts , Bay City, Mich.

THE MICROSCOPE.

VOL. VI. DETROIT, OCTOBER 1886. No. 10.

ORIGINAL COMMUNICATIONS.

A SIMPLE FREEZING APPARATUS.

BY FRANK W. BROWN, M. D.,

Professor of Histology and Microscopy, Detroit College of Medicine.

THOUGH the ordinary method of hardening a specimen in alcohol and cutting at one's leisure is much to be preferred, there are times when a rapid microscopical inspection is desired, or, what might be called an exploratory examination is to be made, to learn if an organ or other object be worthy of the slower and more thorough process, preparatory to a permanent mount. For sections that have been frozen, do not, as a rule, keep as well as those that have been hardened in alcohol, though they do equal service at the time of mounting.

The most convenient method of freezing is by evaporation, and the agent generally employed for that purpose is sulphuric ether.

Within the last few months a company has begun the manufacture of a liquid, the principal use of which is as a disinfectant. It was invented by M. Raoul Pictet, of Geneva, Switzerland, and is said to be composed of sulphurous anhydride (SO_2) and carbonous anhydride (CO_2). These gases are mixed and then cooled, and subjected to great pressure, sufficient to condense them to a liquid form. This liquid is then stored in ordinary siphon bottles for convenience in handling, and placed on the market.

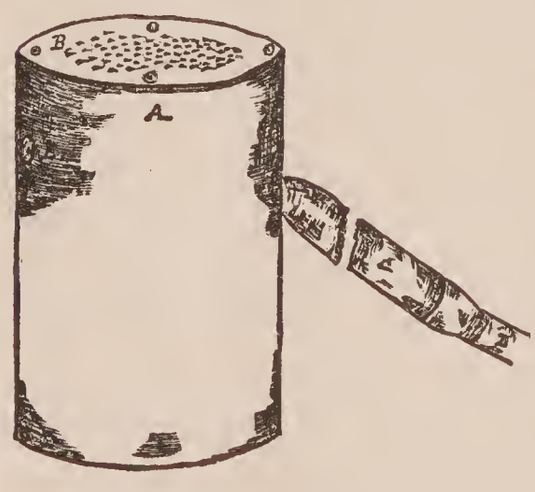
Liberated slowly from the siphon it appears as a gas, when quickly, as a liquid. Relieved from the pressure, the liquid evaporates very rapidly, thus producing an intense cold on any surface to which it may be applied. Mercury is frozen by it in a very short space of time, and the skin can be made quite "solid" in from five to ten seconds.

It occurred to me that this cold-producing quality could be utilized in microscopy for the freezing of specimens for section cutting, and to learn its effect as compared with ether, a few experiments were undertaken.

The instrument used was the ordinary one consisting of a thin, metal stage arranged over a small chamber, to which air is admitted by several perforations at its sides. The spray tube is inserted into this chamber in such a manner that the ether is thrown against the under side of the stage, causing, by its evaporation, an intense cold. A small specimen, glued with gum arabic mucilage to the upper side of the stage was thus frozen by ether in five minutes, and this sufficient for the cutting of thin sections. The Pictet fluid did the work on a like specimen in one and a half minutes. Aside from the rapid action of the latter, it had the advantage of a more permanent effect, so that many more sections could be cut than when ether was used.

In the above trial the Pictet fluid was applied by attaching a piece of rubber tubing to the mouth of the siphon, and this to a glass tube drawn somewhat to a point at the end. I found, however, that the substage chamber of the freezing instrument was too open for the fluid, much of which bubbled out and was lost. This led me to devise a new arrangement, which was found to be not only far superior for the Pictet fluid, but for the ether as well.

A large cork (*see cut*) of firm texture was obtained, and a square chamber, about one half inch in depth, was hollowed out at one end. (A.) A round opening was then bored, running from the center of one of the base lines of the chamber obliquely downwards and outwards, for the introduction of either spray or glass tube (C). On the other side of the chamber, though not directly opposite, a small hole (E.) was made to serve as a vent. The top was then covered with a thin piece of zinc plate, (B.) securely tacked on. The upper surface of the plate was then nicked, (not perforated) with the point of a knife blade, and the thing was done. If ether is used, some little saving can be accomplished by boring a hole from the bottom of the chamber



to the bottom of the cork. This will act as a drain, but it should, of course, be securely plugged during the freezing operations. The advantages of this extemporaneous arrangement were seen in that not only was the chamber more confined, thus preventing waste, but the cork, being a poor conductor, caused a much more rapid cooling of the metal stage.

A specimen of the size used in the first experiments was frozen on this modified instrument in one and a half minutes by means of ether, and in thirty-five seconds by that of the Pictet fluid.

The advantage of the Pictet fluid over the ether is the rapidity and permanency with which it freezes the specimens. This permanency is an important feature, as it allows many sections to be cut before the specimen slides from the stage. Its disadvantage is the intolerable and penetrating odor, identical with that of a burning sulphur match. As the freezing time is so short, the operation can be done out of doors; for, when finished, the odor, though disagreeable, is quite bearable.

The object of this paper, however, is more to call attention of the reader to the extemporized instrument. Though hardly original, it is so simple in its construction, that he who does not possess a freezing apparatus can easily construct one equal in efficiency to any I have seen on the market. For using ether, an ordinary perfumery atomizer will answer. The spray should be a liberal one and moderately fine in quality, and a double bulb should be used to make it steady. If properly made, and it is difficult to see how it could be done otherwise, I am confident it will prove a useful addition to the working table.

VICTORY AT LAST.

C. H. STOWELL.

SOME of the old friends of "THE MICROSCOPE" will remember how its editors were taken to task for speaking boldly concerning certain most unjust and uncalled for attacks upon it.

The facts were, that a certain self-assertive egotist thought no one could edit anything in the microscopical line but himself. So it set itself at work to crush his young opponent. How well this was done is shown in the foremost position held by the journal to-day. The editors of THE MICROSCOPE were not

slow to see what their smooth-tongued enemy was after, and in a series of editorials he was exhibited in his true light. Now comes the interesting part of our story: An editorial appeared in his microscopical journal pretending to give an account of the year's work in microscopy in this country, and concludes in paying us a compliment by saying, that so far as American journalism is concerned outside of his own journal, it has been devoted largely to personalities; that popularity thus purchased is costly and short-lived, and that no journal devoted to science would allow personalities to enter its columns. All this is written as the prelude to a very pretty story. Will our Japanese editor turn to p. 692 of the August number of the Royal Microscopical Society and read the article by one of the editors on Central vs. Oblique light? We doubt if any instance can be found in "American journalism" that partakes more of the *persona* element. This journal says: "There are occasions when personal attack is the only remedy except silence, which is open to the aggrieved party." The highest authority, then, in the world, passes judgment and says at times that it is right to go to war. Before this bar we stand acquitted of the charge, that it is unscientific to hurl back the sledge-hammers that are thrown at us.

But again, this editor even goes so far as to say, that he "finds it impossible to believe that Mr. Nelson can have *honestlyl* supposed his ideas to be held by any human being." A charge of dishonesty. Did we ever go farther?

But again, "Mr. Nelson attributes to the society the most absurd views for the purpose of *glorifying himself.*" Did we ever accuse our enemies of more? But again, "When he returns to the usages of all decent persons." Did we ever do worse than to call our opponents indecent? But again, "Mr. Nelson has never read the paper which he so elaborately criticises, either in the original German or translation." Have we ever said stranger things?

Our readers are not interested in this controversy across the waters between certain parties and Mr. Nelson, and the above quotations from this controversy are here given simply to show that this highly scientific journal, the organ of the renowned Royal Microscopical Society of London, does not think it beneath its dignity to repeal its attacks in the most severe and personal manner.

In fact we never read an article equal to it in this line, yet to those who are acquainted with the circumstances, the answer comes, "no article can be written severe enough to meet such cases."

Although it has taken nearly six years of waiting to do it, we now present to our Japanese editor the instance quoted above. Will he now declare that even the Royal Journal is unscientific and unworthy of notice? We shall await with interest his decision.

These closing days of our editorial work are indeed days of peace and comfort; for even our most bitter enemy must acknowledge the justice of our course and ascribe to us victory at last.

PROCEEDINGS OF SOCIETIES.

AMERICAN SOCIETY OF MICROSCOPISTS.

S. M. MOSGROVE, M. D.

TO the pilgrim of microscopy, arriving at Lakewood, wearied from his days hot, dusty car-ride, the realization of an hour's ride on the boat up Lake Chautauqua, was refreshing, the ripples reflecting the moon's rays in silvery sheen, thus delighting and soothing both eye and ear, with a feeling of rest and quiet and preparing one with pleasant anticipations of the morrow.

Chautauqua, with its wide-spread reputation, its temples of learning, situated amid sylvan groves, thus offering ample opportunities of communing with nature, seemed a fit place for a meeting of microscopists.

So when on Tuesday afternoon, August 10th, the President, Prof. Burrill, announced the opening of the ninth annual session of the American Society of Microscopists, there was an attendance of fully one hundred enthusiastic members at the "Children's Temple."

In view of the importance of the subject, "Detections of Adulterations of Butter," and the presence of Dr. Thos. Taylor, of Washington, and Prof. B. A. Weber, of Ohio State University, the executive committee had decided that the entire afternoon should be devoted to its discussion.

Prof. Weber opened the discussion with a paper entitled "Mi-

croscopic Examination of Butter, and its Adulterations." The following is a brief resumé of the points made :

He analyzed Dr. Taylor's method, now well known, for the examination of butter and fats, and divided it into three parts, viz : the detection of foreign bodies other than fat; the examination of the commercial fat by polarized light without further treatment, and lastly, the examination of the crystalline nature of butter and other fats, after submitting them to heat according to his well-known directions.

The first part of the method was, in the opinion of the speaker, the only one which gave any promise of true value, yet it was the one upon which its author (Dr. Taylor) laid least stress and considered of least value. By this method tissues, and other foreign matters, that would suggest the origin of a product and thus distinguish it from pure butter, might easily be discerned and recognized. As to the second part of Dr. Taylor's process, while tests of unprepared fats made with polarized light, as directed by the doctor, apparently confirmed his statements, (viz : that the normal butter, over the green selenite-plate, displays an even green color, while lard and other fats display prismatic colors due to the crystallizations present therein,) the fact is that the confirmation is only apparent—and the conclusions drawn from it by Dr. Taylor are opposed to all law and reason. The difference in the behavior of the butter and the other fats is due not, to any inherent property in either of them, but to the difference of the conditions in the treatment which these fats had undergone prior to reaching the experimenter's (Dr. Taylor's) hands ; in other words, that, had the butter been subjected to the prior treatment, which the other fats had undergone, it too would have displayed prismatic colors. Dr. Weber cited a number of experiments made by him to prove this point, and finally gave, as an explanation of the fact that the fresh, unmanipulated butter had shown an even field, the statement that the natural crystals of such butter were exceedingly minute, and hence produced an effect on the polarized rays so obscure as to be almost or quite inappreciable. By melting any of the other fats which had produced prismatic effects, and suddenly cooling them so as to break up their crystals into forms as minute as those of butter, the very same results were obtained.

A most important deduction made from these experiments is

that by varying the conditions, through which each fat is made to pass in preparing it for market, genuine butter may be made to asssume the appearance described by Dr. Taylor as specific for other fats, and *Vice Versa.*

Passing to third the part of Dr. Taylor's method, the speaker in detail the microscopical appearance which the doctor claimed gave distinguished true butter from all other fats, viz. a globular crystal, which under the polarizing apparatus alone, shows a black St. Andrew's cross, and which, when a selenite is used, gives a display of colors with the cross in faint outline. Secondary crystals, of a rosette form, are also occasionally seen. These appearances are, according to Dr. Taylor, never seen in any other fats. The speaker stated that he had made three sets of experiments to test this statement of Dr. Taylor's, using pure creamery butter, made in the institution with which he is connected, (the Ohio Sate Agricultural Experimental Station) oleo-oil and lard, and the results fully bore out Dr. Taylor's announced discoveries. Pure butter, the oleo-oil and the lard, each produced its own distinctive crystalline forms, as described and figured by Dr. Taylor, and if a test to distinguish pure butter from pure lard or pure oleo were wanted, nothing could be better. It is manifest, however, that no such test is needed, since taste, smell and sight serve the purpose. What is wanted is a test that will tell a mixture of any of these fats with butter, and this, said the speaker, Dr. Taylor's test signally fails to do. Whenever a mixture of these fats is made with butter, and the resultant mass is studied under the microscope, as described by Dr. Taylor, it will be found that the crystals of the adulterants unite with the butter crystals and form globular crystals which behave in all respects exactly like those obtained from pure butter alone. Prof. Weber detailed a large number of experiments made by him and all of which prove this fact. But more than this, the speaker stated that he had, by varying the treatment, succeeded in obtaining from mixtures of oleo-oil and lard, and from oleo alone, globular crystals that could in no respect be differentiated from those obtained from pure butter.

In conclusion Prof. Weber stated that he had undertaken his experiments with no prejudice to Dr. Taylor, and with the simple desire of arriving at the truth alone. He had come to the conclusion—the only one that could be drawn from the results obtained

by him—that the microscopic methods of Dr. Taylor, for the differentiation of butter and other fats had no practical value in the examination of adulterations, the only direction in which such a method is of any necessity.

Prof. Weber illustrated his paper by quite a number of "blue prints" made from negatives by Dr. A. J. Detmers.

Dr. Taylor in replying, showed on the blackboard, the appearance of the different crystals, etc., and commenced by alluding to the first three experiments made by Prof. Weber in relation to the crystals of butter, lard and oleo fat. Here Dr. Taylor called attention to the fact that Prof. Weber acknowledged that thus far Dr. Taylor's statements in relation to the forms of the three respective fats named were verified. The next following three experiments of Prof. Weber were reviewed by Dr. Taylor. They related to three different compounds of butter and lard. The first composition consists of ninety parts butter and ten parts lard; second composition seventy-five parts butter, twenty-five parts lard; third composition fifty parts butter, fifty of lard. Each of these compositions was boiled, cooled and examined by Prof. Weber. He says all exhibited the butter crystal. To these three experiments Dr. Taylor objected because they did not represent his method of testing for oleomargarine. Dr. Taylor in his annual report to the Commissioner of Agriculture sets forth that it is absolutely necessary to examine all butter substitutes as purchased. By this means the crystals of lard, if present, are at once detected by means of the microscope. The object being to distinguish foreign fats, such as lard and beef, which are never found in pure butter, Dr. Taylor explained that it was a great error on the part of Prof. Weber to boil a suspected butter on receiving it, because were butter present in quantity in combination with lard and beef fat, the foreign crystals would be absorbed by the large butter crystals formed by the process of boiling. It should be observed that lard and beef fats have passed through the process of boiling, while the butter combined with it has simply been melted at a low temperature. In normal oleomargarine their crystals are already formed while the butter shows none unless boiled. To a superficial observer boiled oleomargarine, if it contain much butter, would appear true butter instead of oleomargarine. Whereas, by first making a

microscopical examination the lard crystal may be at once detected and save further labor.

Dr. Taylor further stated that it should be borne in mind that the object sought was not the presence of butter, but the presence of foreign fats, and that the moment they were detected by the microscope, the parties may be prosecuted under the butter laws of the District of Columbia.

Dr. Taylor here stated that already seven convictions had been made under his testimony, and in no case had he sanctioned a prosecution, unless he found an abundance of lard or beef fat crystals, or other foreign fats in the substance. Dr. Taylor further said that the parties subjected to the prosecution, rich and poor, men and women, publicly acknowledged, on conviction, that they knew that the substance they were prosecuted for selling was oleomargarine. Following this Dr. Taylor discussed the experiments of Prof. Weber in relation to the production of the so-called butter crystal by artificial means. Dr. Taylor said that Prof. Weber believes he has by the use of salt and water in the manner described by him, formed or caused to be formed, butter-like crystals by using either oil or lard. In relation to these experiments Dr. Taylor stated that he had lately found that while the kidney and cellular tissue fats gave purely stellar crystals without a cross, that a sample of leaf lard, lately tested by himself, yielded stellar crystals with a cross, but these crystals could not be mistaken for butter crystals by an experienced observer, since they show distinctly the spinous character of lard crystals. That the same result is obtained without the use of salt and water is shown also, in this connection. Dr. Taylor stated that, in point of fact, the introduction of salt and water was not necessary to produce the cross. Dr. Taylor cited the number of fats that he had examined showing in their first stages of crystallization a globose crystal with cross, all without the addition of salt and water. Dr. Taylor here gave four illustrations upon the blackboard of four different fats whose forms could be seen with plain transmitted light. Following this Dr. Taylor threw the form of a cross on each of the illustrations, pointing out the fact that notwithstanding that each was invested with the shadow or illusive marking of the cross, each form could still be distinguished one from the other by reason of their peculiarities, thus showing that the presence of the cross would not alter the

identification of lard, beef fat, or other crystals. Dr. Taylor further stated that when Prof. Weber melted a fat and cooled it quickly and found that no crystals had formed under these conditions, he but verified what, he Dr. Taylor, had published some ten years ago in the *New York Quarterly Journal of Microscopy*, to wit, that butter substitutes composed of solid fats when newly made and suddenly chilled, did not show any crystals of fat when examined in the fresh condition; but that when boiled and laid aside a short time, in a moderate temperature, the crystals began to form and are readily detected. Dr. Taylor further observed that in no case had he found in oleomargarines, or butterines sold in Washington markets, butter crystals on boiling: he invariably found foliated crystals of beef fat.

Dr. Taylor strongly objected to Prof. Weber's constant use of the term "Characteristic of the Butter Crystal" within quotation marks, stating that nowhere in his writings or public speech has he stated that the cross was characteristic of the butter crystal, meaning thereby that the St. Andrew cross, so called, was to be found nowhere except in the globose butter crystal. Dr. Taylor has shown that the cross is only a factor, and does not contend that it is exclusively characteristic of the butter crystal. The butter crystal, he stated, had several peculiar characteristics, which he had not yet found in connection with any other crystals of fat, animal or vegetable.

The secretary announced the receipt of a fine slide presented to the society by Mr. Fassoldt, of Albany, N. Y., the well known preparer of fine rulings on glass. This slide has lines varying in fineness, from the one five thousandth to the one two hundred thousandth of an inch. A vote of thanks was on motion tendered Mr. Fassoldt for his present.

As Mr. Fassoldt claims to have seen these lines, some discussion ensued as to their resolvability, many doubting that it could be done.

Notice being given of the death of Rev. J. T. Brownell, a former well known member of this society, the secretary was instructed to prepare a suitable memorial.

Thirty-five new members were elected and the session closed.

An evening session was held for the purpose of listening to the annual address by the president, previous to which Dr. J. A. Vin-

cent delivered a most cordial and eloquent address of welcome to the society, and gave a resumé of the work done at Chautauqua. Engaged as the doctor is with this work, and as many of the schemes have emanated from his active brain, his description proved highly entertaining to our members, who were surprised at its immensity and the number of persons in distant parts of the country who were being benefitted by its teachings.

President Burrill on behalf of the society thanked Dr. Vincent for his hearty welcome, and assured him of our earnest sympathy in their methods of progressive education—that we felt that it was good to be here and would leave with enlarged ideas of the "Chautauqua University."

Prof. Burrill then proceeded with his address on "Bacteria and Disease" a very comprehensive and clearly presented paper.*

Wednesday proved to be a very interesting day. After the admission of new members, an interesting paper by Dr. R. H. Ward was read on "Micrometer wires," which described how fine wire could be made, by making a pencil of silver enclosing a core of platinum and drawing it down to one five hundredth of an inch: that when the silver is dissolved off with acid the platina wire is found to be one five thousandth of inch in size, even throughout, and much preferable to spider-web for micrometer, as it is more distinctly seen and more durable.

Dr. Geo. Fell's paper on "Demodex Falliculorum" followed and elicted considerable discussion. Though so commonly present in the human face, it has not been considered to be the cause of any eruption or disease, but Dr. Fell is inclined to think, that the mite is perhaps the real cause of a common skin disease like acne.

Mr. Vorce stated that he had examined pork flesh and found a *demodex* with pointed extremity, as illustrated in Dr. Fell's drawings and that he understood the *Demodex Falliculorum* to have a rounded extremity, but Dr. Fell insisted that it was the exact form he had found in many cases of both men and women and that it was not due to effect of any re-agent.

The afternoon session opened with "A Reply to some Arguments that have been advanced against the Comma Bacillus of Asiatic Cholera," by Dr. Geo. W. Lewis, of Buffalo. The doctor delivered a conclusive argument sustaining Dr. Koch. Having had

* See September MICROSCOPE.

the advantage of two and a half years study in Germany, he was fully conversant with Koch's methods and while the bacillus is of the character of a spirillium and difficult to detect by the microscope alone, the true way to determine species of bacteria is by pure cultures. At any rate the doctor believes if this organism is only kept out of America we shall have no cholera.

Jas. E. Whitney, of Rochester, gave his method of preparing wax mounts; claiming that by thoroughly coating the wax cell with cement and allowing it to dry well before using, the sweating avoided. Mr. Whitney passed around a number of elegant specimens of his work. In the discussion Prof. Rogers stated that he had several times thought he had overcome the sweating but had always failed, and any successful method would be very welcome. This was a nice and easy method of cell making. Prof. W. H. Seaman, of Washington, D. C., explained that the sweating was caused by the volatile portion of the wax, and as long as the cement prevented decomposition it would be good, but in time it would fail. He would suggest paraffine as a good substitute.

"Some New Instruments for mounting," by Dr. F. L. James, of St. Louis, consisted of an ingenious combination of a mounting box with a glass top and a mirror set at an angle below to properly illuminate the mount examined through a lens held on a wire with universal joint. Second, "A Cover Glass Holder" composed of a spiral spring bent round a cork on a foot, thus securely holding the cleansed cover glasses ready for use.

Dr. F. S. Newcomer, of Indianapolis, then described, in a most interesting manner, his methods of arranging diatoms, kindly replying to all inquirers, which were many, as all who had seen, or better still, were possessors of specimens of his beautiful slides, were anxious to learn his secrets of arranging. The doctor replied that there was no royal road of success, but that it required patience, cleanliness and perseverance: the trio which are so necessary in all successful microscopical work. Dr. John Sloan, of New Albany, Ind., also detailed his experience in arranging diatoms.

The Society then adjourned and some thirty-five members acacepted the invitation to participate in "The Dredging Expedition," under the management of Professors Kellicot and T. B. Stowell.

A steam yacht was secured and the start made for a very pleasant ride on the lake, enlivened by the presence of a number of our

lady members, whose gay apparel and handsome faces gave us the appearance of being more bent upon pleasure than science. But such delusion, however, was quickly dispelled upon hearing them learnedly discoursing upon infusoria, entomostraco, etc., especially when Mr. Chas. Fellows would empty the handsome silk net, with which he was skimming the surface of the lake amidships, while Prof. Kellicott at the bow and Prof. Stowell at the stern were sweeping the bottom of the lake with their weighted dredge nets at depths of fifty to seventy feet, ably assisted by Messrs. Oviatt and Sergeant.

Part of the apparatus was made especially for Prof. Kellicott, while the rest was loaned for the purpose by the United States fish commissioner.

This expedition, while a new departure, was a complete success, and will undoubtedly be repeated at future sessions, when rendered possible by proximity to lakes or rivers. While the find was only casually looked over, some new forms were discovered, especially *Heptodoca Hyalina* a beautiful crustacea, heretofore not obtained in this part of the country.

Thursday proved the day of days. So when Prof. Burrill announced the opening, the attendance was about doubled and increased interest manifested. After the election of new members, the appointing of the nominating committee resulted harmoniously in the selection of Dr. H. J. Detmers, J. D. Cox, H. L. Smith, O. C. Mellor, H. D. Kendal, John Sloan and Edward Bausch.

Dr. Jas. S. Reeves of Wheeling, W. Va., described "A Section Flattener," which he had devised and found useful, consisting of a strip of paper glued to a wire the ends of which were bent over the knife blade.

Dr. Charles E. West, of Brooklyn, then read a paper entitled "Forty years with the Microscope," detailing how in 1842 he had secured his first instrument, endorsed as the best, Cheralier had ever made. From this on his interest had never flagged, purchasing improved objectives on their first appearance, including one-fiftieth inch. It was understood that Dr. West had at one time owned ninety objectives.

"A further study of centimeter scale 'A,'" by M. D. Ewell, of Chicago, was read by Professor Rogers. This scale is owned by the society and was made and compared by Professor Rogers with

the standard at London and Paris. Dr. Ewell had examined this scale every day for thirty days by a comparitor with microscope attachment, and while variations of temperature cause differences in length, owing to the expansion and contractions of metals, yet a mean of his measurements are almost identically the same as Professor Roger's.

Dr. Fell said that we might well be proud of such work as it is not surpassed in the world, and we now have standards for minute measurements which are perfect.

Professor Rogers then followed with a paper "On methods of dealing with the question of temperature in the comparison of standards of length," and exhibited a new form of metal thermometer of his own construction, which is extremely sensitive.

Erle H. Sargent read a paper "On the use of Nitrite of Amyl for fine injections." The inhalation of Amyl dilates the capillaries and blood vessels, thus permitting their more perfect injection.

"Notes on Argulus Cotostomi, a fish parasite," and "On some new or rare Infusoria," by Professor D. S. Kellicott, were read by abstract.

Meeting adjourned.

Friday, though the last day, was a busy one.

The morning opened with a fair attendance. Ten new members admitted.

During the working session yesterday, Mr. Griffith with his usual generosity, distributed a mass of diatomaceous material from his private box, in which were some valuable slides and books which were erroneously distributed. It was, on motion, resolved to call attention to this fact and to ask their return as they were undoubtedly taken under misapprehension.

The committee to audit Treasurer's account, reported through Dr. Newcomer, as follows:

Cash on hand, August, 1885, ...	$407.65
Received during the year, ...	401.26
	$808.91
Expenditures, ...	693.06
Leaving cash balance, ...	$115.85

On motion, report received.

Committee on Rules, by Gen. J. D. Cox, reported progress, and

requested further time and the addition of Dr. George Blackham to the committee, granted.

Gen. Cox then reported for the Nominating Committee, the following list of officers:

President, Professor Wm. A. Rogers, of Harvard; First Vice-President, C. M. Vorce, Cleveland, O.; Second Vice-President, Dr. James E. Reeves, Wheeling, W. Va.; Assistant Secretary, Dr. S. M. Mosgrove, Urbana, O. Secretary Kellicott and Treasurer Fell, holding over. Executive Committee, J. J. B. Hatfield, Indianapolis, Dr. W. R. Manderville, New Orleans, and A. B. Clapp, New Albany, Ind.

Also reported a resolution thanking Mr. Griffith for his past arduous services, and urging his continuance as manager of the Working Session.

On motion the Secretary cast the vote of the society declaring the election of the above officers.

The Committee on Resolutions offered Resolutions of Thanks:

To the U. S. Fish Commissioner for loan of net.

To the officers of the Chautauqua Assembly for the courtesies and favors shown the Society, and especially to Secretary Duncan and Mr. Hall, for their active labors in behalf of the meeting.

To the *Assembly Herald* for its full reports of the proceedings.

To Professor E. A. Spring for a medallion, modeled in honor of the society.

All of which were unanimously passed upon.

The committee on "Butter and Fats," reported, "Commending Dr. Thos. Taylor's method as being very useful in determining butter adulterations, but not sufficient of itself to be entirely depended upon."

"Fresh Water Sponges," by Henry Mills, was read by title.

"The Meibomian Glands of the Cat," by E. H. Sargent, show a number of serial sections and illustrated by drawings demonstrating the anatomy of these glands, and the difference noted between the human and the cat—in shape and size of tube. Prof. Stowell expressed his interest in the subject, and Dr. Fell spoke commending this work and hoping we will have more such. In the discussion following some one inquired as to the use of these glands in the cat, and whether a cat cried. The witty reply was made that when it did the lachrymal glands of the "hearer" (ear) were more apt to be affected.

B. L. Oviatt then showed how to "Section fresh Cartilage," by imbedding in paraffine, and using serum or normal salt solution sections could be made and preserved without shrinking in picric acid and alcohol.

That inveterate inventor, Mr. E. H. Griffith, then showed several new devices, viz: An aid in focussing objectives, which consisted of a wire running through a slot along the objective and fixed with a set screw when the latter is once focussed, thus permitting its return by racking down until the end of wire touches the slide. It is very convenient where one is arranging diatoms, etc. Second, a "Mechanical finger, two for a penny," a piece of brass plate, with a hole in one end, slipping over objective and bent at the other, to carry needle or whisker; also, Filonite cells made of celluloid which can be thus made true and yet easily changed by slight heating, and much cheaper than glass.

"Optical Errors and Human mistakes," a paper by the optician, Ernst Gundlach, was read. Opticians have been constantly at work desiring to improve their objectives; both in the correction of the spectrum and in the glass. Some English makers got out a glass about twelve years ago, claiming an improvement, but an order from Mr. Gundlach was never filled, and he understood that the glass was too soft. From the best he could learn, he feared the same fate would meet the latest claims in Germany. He regarded the advance which was claimed in superiority of the new objective was owing to their fire lenses and not so much the quality of the glass.

Dr. Blackham said that years ago Mr. Spencer told him the next great improvement in objectives must be in the glass composing the lenses, and that he had experimented in that direction, but the glass thus made was too soft and deteriorated by the air alone. Dr. Blackham feared that the present claims were exaggerated. He thought that the eye pieces should be improved. Prof. Burrill also spoke in a similar strain.

"Photo-Micrograph vs. Micro-Photograph," by A. Clifford Mercer, in which he gave his researches into the origin of the words and declared in favor of the first as being the older and and proper designation. Prof. Rogers also urged the use of "Mikron," in place of Micro-millimeter.

Edward Bausch then exhibited "The Inverted and Vertical

Microscope," which he has just gotten up, at request of a number of laboratory workers for chemical work. This instrument, a modification of their well known stands, inverted with a prism below, has all adjustments and works perfectly. By withdrawing the prism and changing the tube and reversing the stage, it is instantly changed into a good verticle microscope. Much admiration was expressed for it, and it was thought by the addition of an erector, it would surpass all others as a dissecting microscope.

The last paper read was by Eugene A. Rau, of Bethlehem, Pa. "An account of a Microscopical Examination made in two fatal cases of Trichinosis," illustrated by photographs. The discussions following brought out the full history of Trichina.

"The Microscopical Anatomy of the Ovary," by Dr. W. P. Manton, of Detroit, Mich. "Results of further experimenting in the use of Media of high refractive index," by Prof. A. L. Smith, Geneva, N. Y., and "On the amplyfying powers of objectives and oculars," by Dr. George Blackham of Dunkirk, N. Y., were read by title.

Treasurer Fell reported that the Tolles and Spencer fund amounted to $95.20. Considerable discussion ended relative to its disposal, but on motion the matter was laid on the table till next meeting.

Drs. Geo. Blackham, R. H. Ward and H. J. Detmers, were, on motion, appointed a committee to examine the Fasoldt plate of rulings.

The following resolution was offered, viz: "That all members of this Society, in good standing for five consecutive years, shall be made *Fellows*, and be eligible to office, and that others shall be members only, and not eligible to office until they become Fellows.

Invitations were extended the society to hold its next meeting at Indianapolis, San Francisco, or Washington City, the merits and advantages of each being eloquently put forward by their proposers. The subject was referred to the Executive Committee without advisement.

Prof. Burrill in announcing the close of the session, returned thanks for assistance and expressed his confidence in the future greatness of the Society, and then gave way to his successor, Prof. Wm. A. Rogers, who on taking the chair, said "Two years ago when you did me the honor of the nomination, I was, for unavoid-

able reasons, compelled to decline, and now that I am again the recipient of the honor, I accept the service with heartfelt thanks and promise to do the best within my power.

A vote of thanks was unanimously extended to the retiring president, Prof. Burrill, for his indefatigable energy and impartial rulings during the session.

Then the Society adjourned *sine die*, after a most successful meeting. Upwards of a hundred new members were admitted and Treasurer Fell reports the receipt of more money than at any previous meeting.

THE WORKING SESSION

Was the objective point of all, both members and visitors, and was held at the Gymnasium, on Thursday afternoon, at two o'clock, where the exhibition at twenty-five tables fully realized the expectations of all who knew that Mr. E. H. Griffith was once more in charge. The only criticism that could be made was the absence of a number who had promised to be present and were therefore down on the programme, which had been conveniently prepared for the use of visitors, thus rendering it confusing to one referring to the numbers. But those present, by their expertness and cordial explanations of the different steps in mounting, etc., alone amply repaid one for the trip.

Taking the tour of the room, we successively witnessed the mounting of different varieties of blood; Brearley's ingenious holder for telescopes with universal movements, and, of particular interest to physicians, the detection of tube casts, their significance and methods of mounting, as explained by Dr. Geo. Fell. The methods of obtaining, dissecting and mounting entomostracea, as demonstrated by Mrs. Chas. Fellows, was also a point of great interest. Mr. Griffith ,between times of distributing Diatomaceous material, showed how to entertain with the microscope with common objects within the reach of everyone. Dr. Lucien Howe's table was filled with test tubes and an oven, showing the preparation of gelatine culture mixtures, with the cultivation of bacteria from the diseased human eye and their effect on the eye of a rabbit. Dr. F. L. James was surrounded with observers witnessing his methods of silvering glass, and the manufacture of his cements and their proper use. Prof. A. Y. Moore, gave full directions in the

management of the microscope and accessory apparatus. Henry Mills showed the mounting of sponges with some fresh specimens which he had obtained here. Dr. S. F. Newcomer had a crowd of admirers witnessing his deft handling of diatoms with mechanical finger, and arranging them in different designs. Prof. W. A. Rogers' table was occupied with specimens of his unsurpassed rulings and standards of measurements; while the professor showed methods of micrometry. The sliding microtome was in the ascendant and its workings well shown by H. E. Summers in serial sections; and especially by Dr. Jas. E. Reeves, who carelessly sliced sections $\frac{1}{2000}$ of an inch thick and distributed to those who wished them. The doctor has devised an ingenious water bath and oven in which he melted paraffine and prepared his specimens for cutting dry. The section is then fastened to the slide by oil of cloves and collodion and it is run through the stainer, etc., without displacement. His skill gave the Bausch & Lomb Microtome quite a boom. In addition was the table presided over by Prof. Seymour, assisted by Miss Myrtie Crawford, who with a Beck's Schanze Microtome immersed in a vessel of water, cut sections unsurpassed and very rapidly, forty-six per minute, actual count. These sections, both animal and vegetable, they placed in bottles and distributed to the members. One of the most instructive exhibitions, and one fully appreciated, was that by Messrs. Sargent and Oviatt, in a successful method of injecting the blood vessels of a cat previously dilated by the inhalation of amyl, as suggested in Mr. Sargent's paper read in session. Mr. Vorce attracted attention in showing the adulterations of food; while Dr. Thos. Taylor exhibited a great number of specimens of different fats, and gave a practical comparison of lard and butter on the same slide. A. R. Spencer was present and exhibited the manipulation of objectives. Francis Wolle showed preparations of the Desmidacia. James E. Whitney gave full instructions in making cells of wax, "sweat proof;" while C. E. Alling double stained vegetable sections with aniline colors, set with a solution of tannine as a mordant. S. Wilson Baker, assisted by Miss Grace E. Edwards, exhibited the making of wax cells, staining pollens, etc. Mr. and Mrs. Chas. Wellington gave a complete exhibition of mounting, cell making and staining. His card, which he freely offered, was a handsome slide, mounted by himself. The "Duke" is willing to give away anything he has, save his wife and himself.

All in all, it was a very successful meeting. One of the most gratifying additions was the lady assistants, whose presence was most welcome.

THE SOIREE.

Held at the Gymnasium, Thursday evening, was fully up to the previous ones given by our Society. There being no local society to take charge of this exhibition, as heretofore, it devolved on a committee of our own members, who acquitted themselves very creditably, especially Dr. Fell, W. C. J. Hall, C. M. Vorce and Prof. Stowell. A complete programme was furnished, with a list of the exhibitors, and what was to be seen at the different tables. There were one hundred and forty-one microscopes and each exhibitor showed three specimens; changing at the tap of a bell, at 8.30 and 9.00 o'clock. Owing to the many attractions in the city, it was feared we might not have many visitors; but this fear was soon dispelled as eight o'clock approached. Ladies and gentlemen came pouring in, giving the ushers full play in directing them down one isle andand up the next. Fully two thousand persons viewed the different slides of bacteria, insects, sections—both animal and vegetable—and "specimens rare, from water and air," and rewarded the exhibitors with "Oh, my," "How lovely," and "How horrible!"

And it was admitted that the Society had given the Chautauqua public one of the rarest treats in the line of exhibitions it has ever enjoyed.

EDITORIAL.

OUR FUTURE POLICY.

WITH reference to the article by Prof. Stowell entitled "Victory at Last," which appears in this number, we desire to state that, so far as these columns are concerned, it is the end of a controversy with which many of our readers are undoubtedly familiar.

Though we do not care to discuss the merits or demerits of this affair—for it may have both—we should like to call the attention to the fact that the world is full of beautiful and instructive

things relating to microscopy, and because we feel that our pages are none too many to record these, we must in the future, jealously guard them from the encroachments of foreign matter.

The advancement of science depends much on the harmony of its devotees, and we hope, in the future, no action of ours will create a disturbance of this necessary harmony.

WE are constantly in receipt of letters from friends of this Journal who are kind enough to say pleasant things about us, and wish the new editorial staff abundant success in their efforts to make THE MICROSCOPE the best and cheapest publication of its kind in any land. Nothing is pleasanter for us than to receive just this kind of letters, and we hope that future mails will continue to bring us the same encouragement. We venture to suggest, however, that our friends would do us a double service by sending us the names of their acquaintances who own microscopes, or are in any way interested in science or microscopy.

One distinguished worker with the microscope writes us, "I always recommend your journal to such beginners," and adds as postscript the names of some of his friends who should, he thinks, become subscribers.

We hope that others will endeavor to emulate this L L. D.— and thus assist us in carrying out the idea above suggested.

During the coming year we expect to publish articles from the pens of such well known writers as Dr. Alfred Stokes, Prof. A. Y. Moore, Dr. Frank L. James, Prof. Marshall D. Ewell, Prof. C. H. Stowell, and many others distinguished in the field of microscopical research.

So the outlook for the table of contents for 1887 is very tempting. We hope that many to whom this Journal will be sent, who are not yet subscribers, will avail themselves of our offer, and send in their subscriptions at once.

FOR the past two months, on account of the change in proprietorship and the removal of our office of publication from Ann Arbor to Detroit, we have been unavoidably delayed in getting out our issues. We much regret this, and expect hereafter to appear on time.

WE are much indebted to Dr. Geo. E. Fell, Treasurer of the

American Society of Microscopists for past volumes of the society's transactions. These volumes are like mile stones, marking the society's growth, and the ever increasing interest manifested in all that pertains to microscopical research.

NEWS AND NOTES.

DR. C. O. WHITMAN is to edit the *American Journal of Animal Morphology*, Ginn & Co., Boston.

MR. A. C. COLE has found that cassia oil answers well as a mounting medium for some diatoms, (*Heliopelta*, *Cascinodiscus*, *etc.*

ACCORDING to late experiments by Prof. Forster and Dr. Van Geuns the comma bacillus is destroyed by heating the substance containing it to 131° Fahr.

DR. N. POLEJAEFF, of Odessa, has described the keratose sponges collected by the Challenger expedition. Of thirty-seven species secured, twenty-one are new.

DR. W. J. HOFFMAN, of the Bureau of Ethnology, has received the gold medal of the Real Societa Didascalica Italiana, at Rome. This society is mainly composed of anthropologists.

THE September 17, number of *Science* contains an excellent portrait of M. Chevreul, the distinguished French *Savant*, whose centennial festival has just been celebrated at Paris.

FIFTEEN genera of diatoms have already been found in the blue clay at Gray's Ferry bridge. This clay appears to be almost as rich in these organisms as the well known Richmond earth.

PROF. VIRCHOW is reported to have said in a recent lecture in Berlin, "that Pasteur had done the world a great service if he had succeeded only in allaying the fear consequent upon the bite of a mad dog."

GEORGE BUSK, F. R. S., F. G. S., a well known and indefatigable lover and worker in the field of science, is dead. Besides holding several important appointments, he was editor of Wedl's Rudiments of pathological histology.

M. FRANCOIS has found that the nerve connecting the ganglia in the Branchelion (Hirundinea) have a neurilemma and three

nervous cords, and there is no trace of a medullary canal. The cellules of the ganglia are arranged in six follicules and occupy the inferior and lateral regions of each ganglion, two ventral and four lateral.

DR. LEIDY recently stated before the Philadelphia Academy of Natural Sciences, that Mr. Holman while studying amœbæ had observed one burst and disappear. Very small amœbæ were afterwards found on the slide. This seems to indicate reproduction by spores as well as by division.

FOR demonstrating goblet-cells, Prof. W. Flemming recommends not only haematoxylin, which imparts a deep blue or violet color to the contents of the goblet cells in osmium preparations, but also the osmium mixture followed by staining with gentian or safranin. The cell contents then appear blue or reddish brown, and stand out sharply even under low powers.—*R. M. Jr.*

WHEN tissues, and especially nerve tissues, have been overhardened in chromic acid, carmine may entirely fail to stain them. In such a case, the following method (Merkel) is of much service Place a large drop of a one-fourth per cent. watery solution of palladium chloride on a slide, and on another slide a large drop of ammoniacal solution of carmine. Allow the section to remain in the palladium for about two minutes. Wash it in water, and place it in the carmine fluid for about three minutes. Then wash again in water.—*Journal of Microscopy.*

PROF. C. E. Bessey writes to the *American Naturalist*: Last year the writer called attention to the great abundance of rust (*Accidium fraxini, Schw*), on the leaves, petioles, fruits and twigs of the green ash (*Fraxinus viridis*). This was remarkable in the city of Lincoln, so much so as to attract the attention of even the unscientific eye. This year it was expected that the parasite would be much more abundant, but to the astonishment of all, very little appeared. It often required a good deal of searching to find specimens for class illustration. Dr. Halstead, of Ames, Ia., reports an exactly similar condition of things in his flora, the abundance of the last year's crop being followed this year by a great dearth. What can be the explanation of this? Why should the trees be so free this year when such myriad of spores were produced last year?

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

POLLEN and Vegetable slides double stained (new method) 50 cts. each. Slides and formulæ of new stains etc., 75 cts. each. A large variety of pollen, 5 cts. a package..
J. D. BECK, Liberty, (Tioga Co) Pa.

WANTED—A Milliampermeter in exchange for cabinets. slides or cash.
CHAS. BLASDALE, M. D,. Jericho, Queens Co., N. Y.

SLIDES, labels for same and material in exchange for slides.
EUGENE PICKNEY, Dixon, Ill.

WANTED—Microscope of modern make, Bausch & Lomb Investigator preferred. Also Forciminifera Polycistina. Will give fine slides or cash
E. H. RICHARDS, Woburn, Mass.

WANTED—Good Zentmeyer Microscope Stand, Binocular preferred, none but a first class instrument. M. DE BALD, 136 Goodell St., Buffalo, N. Y.

FOR EXCHANGE.—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially desired
ROBT. W. WOOD, JR, Revere St., Jamaica Plain, Mass.

FOR EXCHANGE.—Mounted sections of injected lung of guinea pig.
CHAS. BLASDALE, Jericho, Queens Co., N. Y.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids, of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M. ADAMS, Watertown, N. Y.

DIATOMACEOUS Earth from Denver, Col., in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Col.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds ; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted.
W. FARNELL, Macon, Ga.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7 50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M. D., 547 Clinton Avenue, Albany, N. Y.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc. J. O. Stillson, Indianapolis, Ind.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium having refractive index of 2, 4, can be procured from H. H. CHASE, Geneva, N. Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

WANTED.—Unmounted material of any kind ; foraminifera and diatoms preferred ; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

FOR EXCHANGE—Cathcart's ether freezing microtome, complete. Would prefer an injecting syringe. A. B. AUBERT, Orono, Penobscot Co., Maine.

WANTED—No. 5 of Vol 2, and No. 1 of Vol. 3. This journal. Who can supply ?
D. HUMPHREY, Lawrence, Mass.

FOR EXCHANGE—A new mechanical finger for a copy of Beale or Carpenter ; slide of grouped diatoms for French objective, ¼ inch in focus.
HAROLD POLWE, 136 High St., Peoria, Ill.

WANTED—Complete or partial set of Woodward's photo-micrographs ; also to exchange, photo-micrographs of various objects ; a list of which will be sent on application JAS. B. SHEARER, Cor. Center & Adams Sts , Bay City, Mich.

WANTED—Gross', Erichsen's, or Bryant's Surgery, last edition, in exchange for a 1 in Spencer objective, turn-table, Walmsley pattern, or Microscopical books.
Address, Box 213, Fayetteville, N. Y.

THE MICROSCOPE.

VOL. VI. DETROIT, NOVEMBER 1886. No. 11.

ORIGINAL COMMUNICATIONS.

A CENTRAL LIGHT OBJECTIVE.

A. Y. MOORE, MICROSCOPIST.

A FEW days ago H. R. Spencer & Co., sent me a new objective which was made for Dr. C. Mitchell, of Nashville, Tenn., with the request that I should thoroughly test it. This I have done, and, as the results may be of interest to many I should like to give them.

The objective is marked "1-18—105° B. A.," and is the first objective of that power constructed for the biological series, which has lately been introduced by Spencer. The lens is "first-class" and is mounted in the first-class adjustable mounting with gold plated front, as is usual with Spencer's first-class objectives.

Measured in Chancie's hard crown glass, the aperture is 107° with the systems closed and 96° when opened to the full extent. The magnifying power, measured at ten inches from the object—which, in such a high power is practically ten inches from the optical center, is at closed, 200 diameters, while by opening the systems the power is reduced to 162—thus making an average of one-eighteenth inch focus. The working distance, at closed, is one-fifty-fifth (0.0184) inch and at open point one-sixty-sixth (0.0152) inch. As stated in their price list, the objectives of the biological series are constructed and corrected with special regard to central light work with homogeneous immersion fluid, and as a natural result, this objective is over-corrected for color when used by oblique light or with any immersion fluid having a greater dispersion than that which produces the best results (chromatically) by central light. Used with water the color is over-corrected, slightly, with either central or oblique light.

The resolving power of this objective is better than that of any

lens of its angle I ever saw. By central lamp light, it resolves Möller's No. 15 (*Pleu. fasciola*) into dots; while with oblique light without condenser or hemispherical lens—the resolution of *Am. pellucida* is easy. The crucial test, however, was a silver-plated valve of *Am. pellucida*, shown with the vertical illuminator. By this method the resolution into dots was easy when the light was properly managed, and by slight changes either the transverse or longitudinal lines could be brought out. Selecting a certain line or row of dots, and using a ¾ inch eye-piece, both Mr. C. E. Barr, of this city, and myself counted the dots and got them the same.

I am well aware that many persons doubt the resolution of this diatom into dots, claiming that the apparent dots are caused by longitudinal diffraction lines, crossing the transverse real lines. That this is sometimes the case—especially in photographs—I do not doubt; but when caused in this way the number of dots in any particular row, may be made to change by a very slight change in the focal adjustment, while in the case of a true resolution such a condition is not seen unless the objective be thrown considerably out of proper correction.

When the fine performance of this objective is considered in relation to its very long working distance, it will be seen that it is a glass of more than ordinary utility, for it is a well known fact that good corrections and long working distance are too a certain extent antagonistic; and, although this will not apply with as much force to homogeneous-immersions as to water immersions or dry lines, still it is a matter of considerable importance.

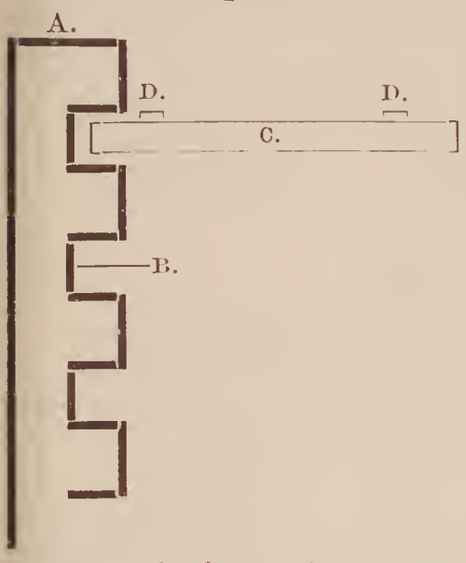
I have seen lenses of far greater relative working distance, but in such cases, even when having larger apertures, the definition has not been equal to those of shorter working distance and narrower angles.

A NEW SLIDE CABINET.

EUGENE PINCKNEY.

A DEMAND exists for a Slide Cabinet that shall be neat compact, accessible, strong, inexpensive and easily constructed. I think I have such a pattern It consists of a box or case containing drawers. with or without a front door. Mine is 14 x 21 x 23 inches, has twenty-seven drawers and holds 1,500 slides on the flat. The case can be made of any size, of hard or soft

wood, stained, painted or polished. The boards for the top, bottom, sides and back, are cut from three-quarter inch or thicker material, to size required, making allowance for a door at front, if needed. The drawer proper, is cut from one-quarter inch material with a front three-quarters of an inch high. Mine has walnut front on pine trays. A slot or groove is cut in each side piece, so that this board, one-quarter inch thick moves easily in and out. When the grooves are cut, they appear as in the figure at B If we need twenty drawers, then twenty grooves are cut in each side piece, and the sides are then attached to top, bottom, and back of case. If the boards for drawers are one-quarter inch thick, the grooves should be cut about nine-sixteenths of an inch apart. This allows one-quarter inch for thickness of drawer-board, filling the groove; one-half inch for strips D, making depth of drawer, and one-sixteenth inch for play. To further stiffen the drawer board and form the sides, strips are cut one-half an inch square as at D, and bradded the length of the drawer. The brads are clinched. One strip is placed on each side of the drawer and on upper side as at D. The space between D and D can then be divided by other strips, as required for slides. The above figure represents a view from the front of A and drawer board C, with side strips D and slots B; the front of drawer being removed. When the front of the drawer is attached the drawer occupies the space from top of D to bottom of C.



It is well to make the drawer two or three inches longer than required for slide space, so that when it is open, and all the slides visible, it is held firmly in position.

THE WORKING SESSIONS.

PHOTOGRAPHY in its application to microscopy, and the dredging expedition on Lake Chautauqua were new features of the Working Sessions of the last meeting of the American Society of Microscopists, of so much practical value that they should be continued whenever possible, in future sessions. An entire evening was devoted to photography under the direction of Hon. J. D. Cox,

of Cincinnati, assisted by Prof. Walmsley, of Philadelphia. The whole process was described by Gov. Cox in his exceedingly interesting way of doing such things while Prof. Walmsley took several photographs at the same time. Some of the good results of the evening's instruction are already apparent, for several who were present have since then become enthusiastic workers with the camera, and they in turn will awaken an interest in others. It was very unfortunate that no reporter was present, but Gov. Cox was so earnestly solicited for some notes, in regard to the evening's work, to be published in the Proceedings that he can hardly refuse to write them. E. H. G.

NEW INVENTIONS.

THE BAUSCH AND LOMB MECHANICAL STAGES.

The instruments figured in (A.) and (B.) are designed to furnish all the movements desirable in this kind of stage.

(A.) is the larger of the two, having a diameter of one and a half inches. It is intended to be used with the "Concentric" and "Professional" microscopes manufactured by this firm. The upper part of the stage is of polished black glass; the slide-carrier is provided with clips and stops for the Maltwood finder; the movements are contained within the circumference of the stage, so that it can make a complete rotation; the rectangular movements are delicate and actuated by two milled heads, placed one above the other; and the edge of the stage is milled, graduated to degrees and silvered.

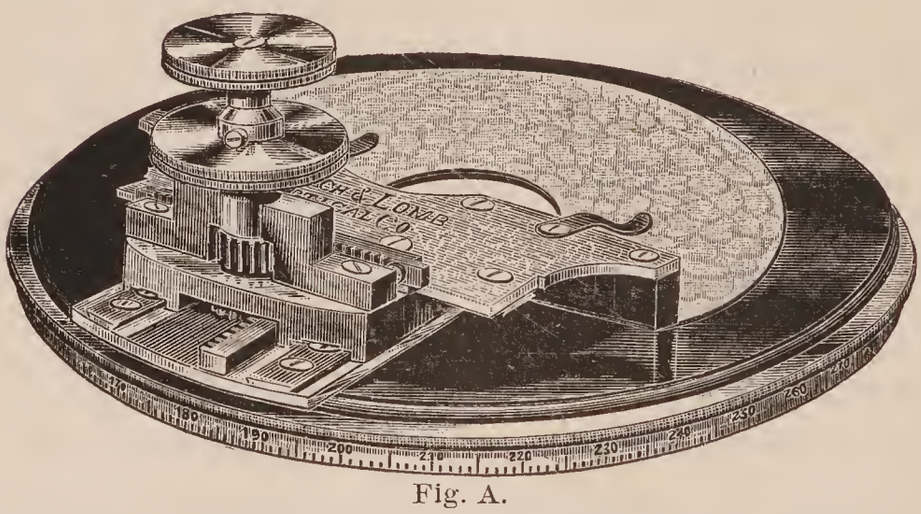


Fig. A.

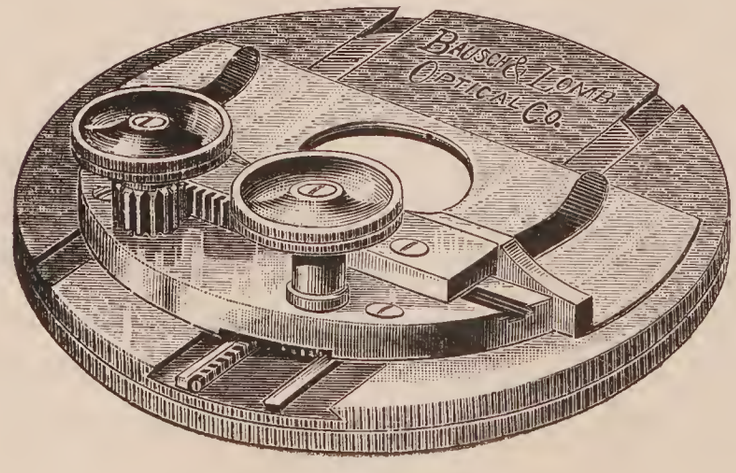


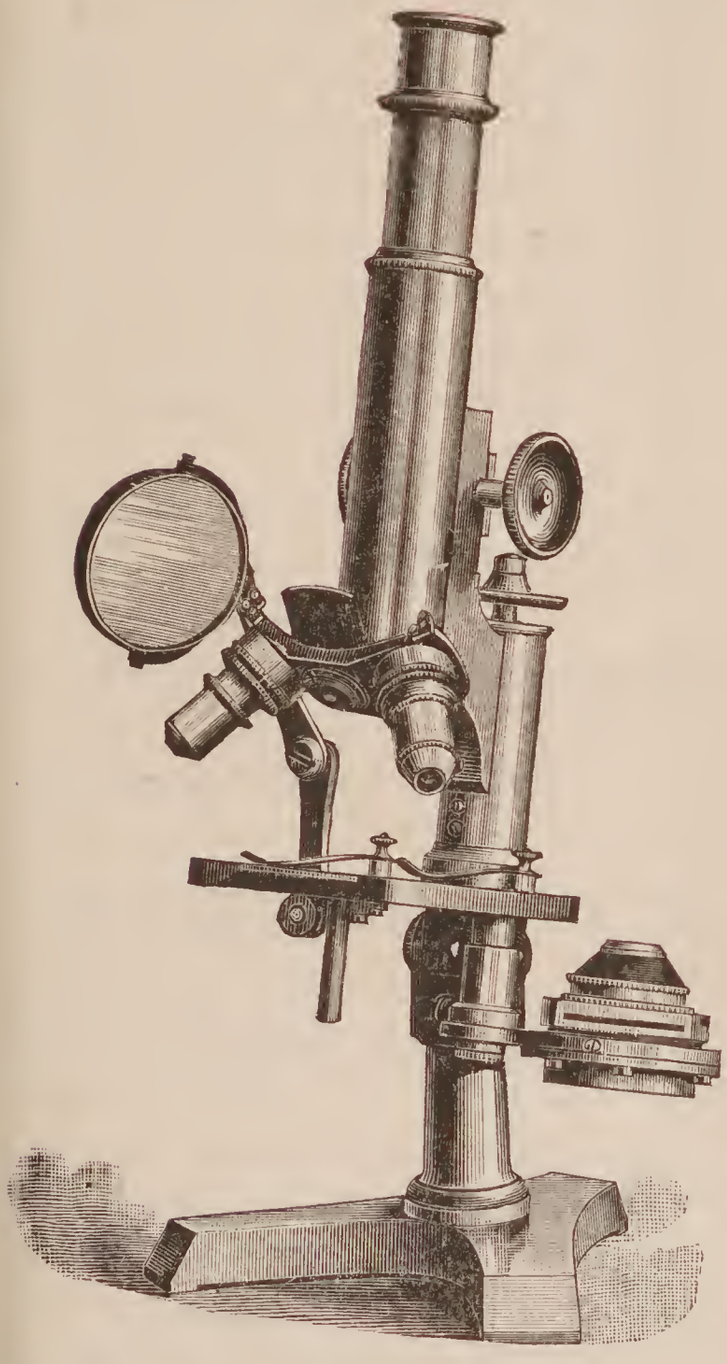
Fig. B.

(B.) is the latest con-

struction, and will fit any microscope having a stage diameter of three and one-half inches. It can be completely rotated, admits the use of very oblique light, and has the clips and stops for the Maltwood finder.

It has the advantage of a variety of movements within a small compass.

THE GRUNOW PHYSICIANS MICROSCOPE.



IN this instrument, which is designed for workers, the whole stand is of brass, with rack and pinion coarse and micrometer screw fine adjustments.

The stand can be inclined to any angle. The mirror is mounted on a double arm so it can be swung above the stage for the illumination of opaque objects. The sub-stage is on a pillar attached to the base of the microscope, and may turned aside, thus facilitating the exchange of accessories without disturbing the object under the field.

The chief points are the mounting of the mirror and of the sub-stage in the manner alluded to: important matters where compactness, with convenience and room is desired.

THE recent unusual demand for THE MICROSCOPE, has exhausted our September edition. We expect later to reprint this number, but subscribers who do not bind or file away their copies of this journal, will convey a favor by returning the September number to us. We will pay ten cents for each copy received in good condition.

PROCEEDINGS OF SOCIETIES.

CENTRAL NEW YORK MICROSCOPICAL CLUB.

THE Central New York Microscopical Club, of Syracuse, N. Y., held its first monthly meeting for the year, September 27th. A large number of members were present and an enthusiastic meeting was held.

President Aberdein announced that arrangements had been perfected for a paper at each meeting of the year, the subject of which would be announced a month before, in order that those who wished might come prepared to discuss the subject thoroughly. He also suggested that an epitomized account of each paper be sent the microscopical journals. Plans were discussed for a soiree, which is to be held November 24th, and suitable committees were appointed. A large number of out-of-town microscopists are expected to attend the soiree.

A number of names were proposed for membership. The society is in a flourishing condition and the outlook for the coming year is very bright indeed.

Dr. E. R. Maxson will read a paper before the club at its October meeting, entitled "The Heavens."

WILL H. OLMSTEAD, *Secretary*.

Syracuse, Sept. 29, 1886.

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

AUGUST 11, 1886.

THE regular semi-monthly meeting of the San Francisco Microscopical Society was held at its rooms, No. 120 Sutter street, President Mouser occupying the Chair.

After the routine business had been dispatched, the President stated that he had ordered one of the objectives recently elaborated by Zeiss from the new optical glass which Dr. Schott and Dr. Abbe have been endeavoring to perfect during the last five years. In the experiments made by these gentlemen, the optical properties of nearly every chemical element were studied, over one thousand prisms of various combinations having been ground and subjected to spectrometrical measurements of their respective dispersion and refraction. The new objective is a one-eighth inch, composed of ten lenses, of which eight are composed of glass containing borates

and phosphates. The use of the new glass has enabled the manufacturers to materially reduce the spherical as well as chromatic aberration, and as a result the performance of the new objective is superior to anything yet obtained.

Mr. Breckenfeldt called attention to some observations of Prof. Campbell, of Detroit, in the June number of the *American Naturalist* on abnormal forms of the fertile part of the alga *Vaucheria*, and exhibited several specimens of that plant, showing abnormal development almost exactly as described by Prof. Campbell. The latter surmised that the peculiarities noted were due to the fact that the plants collected by him had been kept for some time in rather confined quarters; but as the California specimens were found growing freely in a large ditch, and were examined immediately after being collected, the suggested explanation probably needs some modification.

A paper on "Aspergillus," by Dr. Henry Ferrer, was announced for the next meeting.

AUGUST 25th, 1886.

The regular meeting of the society was held at its rooms. Dr. Mouser in the Chair.

A donation of fifty carefully mounted slides of Polyzoa was received from Dr. Thomas Porter, of Sandhurst, Australia. The Australian coast is peculiarly rich in forms of Polyzoan life, and as these slides are authentically named, they will be of great service as aids in determining species of Pacific Coast forms. The thanks of the society were unanimously tendered to Dr. Porter for his interesting gift.

Two samples of diatomaceous earth were donated by the State Mining Bureau.

A number of specimens of *Teredo navalis*, (the ship worm) and of *Limnoria terebraus*, a crustaceous wood-borer, were brought by Mr. Manson, who called attention to some interesting questions regarding the food of *Teredo*—it being asserted on the one hand that albuminous sap of the wood bored by that mollusc was assimilated as food by the animal, while others contend that its food consists of organisms found in the sea water, and that not only the woody fiber but the albuminoids of the sap as well, pass through the alimentary canal of *Teredo* unchanged. Mr. Manson's remarks

called forth an interesting discussion, and the matter will receive further investigation.

The remainder of the evening was occupied by Dr. Ferrer with an exposition of the nature of various microscopic molds, most of which belong to the family *Hyphomycetes*. He said that while formerly the molds were regarded as nothing more serious than annoying invaders of the jams and jellies of thrifty housekeepers, it was now recognized that they frequently exerted a baneful influence upon some living plants and living animals. The destruction caused in the vine by *Oidium Tuckeri*, in the potato by *Peronospora infestans* and in the silk worm by *Botrytis Bassiana*, were cited as instances. The active part played by many molds in some diseases of the skin and mucous membranes in the human subject were also alluded to. After referring to the work done in the last few years by eminent investigators in this field of research, and describing some of their methods of research, Dr. Ferrer closed by exhibiting a large number of cultures of various molds, both innocuous and pathogenic, growing upon boiled potato, agar-agar and other media. Some of those fruits were shown under the microscope, and their characteristics explained by the aid of blackboard diagrams.

A. H. BRECKENFELD, *Recording Secretary*.

EDITORIAL.

THE MICROSCOPE AND ITS FUTURE.

THE great metallic element of iron, has already largely enjoyed its appointed future, for the age of iron, we are told, is soon to give place to one of a metal still grander in its capacity for the varied uses of men.

The "Age of Steam" has also numbered a marvellous list of achievements since first harnessed to practical use. The steamer has conquered the ocean and its vast distances; the locomotive has opened the dark and rugged wilderness; carried the life and genius of civilization into the very heart of slumbering nations, and affiliated peoples, who otherwise must have remained hostile strangers for centuries:—and still the noble conquest goes grandly on.

That subtle and marvellous power of electricity, so recently made captive by the genius of man, is working wonders the world

round; and its brief career is already crowded with achievenents astounding as miracles themselves. To-day it enables the antipodes to clasp hands; and ere long they will talk together "as a man talketh with his friend." But its prolific future is yet to be fully written; and who can grasp its possibilities in the varied agencies that shall yet employ it?

But stepping down from these wider spheres, to more narrow limits in the field of science, and the instruments therein made use of for the discovery and attainment of exact knowledge, we desire here to glance more especially at the future of the microscope. Like the future promise of "the promised land," we may say in the words addressed to Joshua, "there remaineth much land to be possessed."

Although the use of the lens is reputed to have been discovered by Layard in the palace of Nimrod (1500 B. C.), and lenses were referred to as "burning spheres," by Aristophanes in his day (5 B. C.), and afterwards commented upon by the philosophic Seneca in the first century of the Christian era, still, a dozen or more centuries rolled round, before we find a suggestion made for its practical use. Writers and essayists in modern encyclopedias, tell us, that it was not until the 17th century, that the lens, taking the form of the microscope, was employed for scientific investigation, and they give us the names of Malpighi, Lieberkühn, Hooke, Leuwenhoeck and other learned German scholars, as the men entitled to the credit of its introduction to the world of science. But they somehow strangely overlook and ignore that prodigy of learning, Friar Roger Bacon, born in 1214, whose careful investigations and experiments with the lens, certainly entitle him to a high place in connection with the microscope. Did space permit, we would like to refresh the memories of our more accomplished readers, with an extract on the subject from his *Opus Majus*; in which, at considerable length, he asserts and demonstrates his belief (doubtless founded on personal experiments) "*that small objects could be magnified and distant objects brought near, by means of single lenses and combination of lenses*, and that these effects were produced by enlarging, by means of refraction, the visual angles under which these objects were seen. *Wood*, in his history of Oxford, and *Molyneux*, in his Dioptrics, concur with yet other writers in accrediting Bacon, as the inventor of the telescope; but anyone familiar with the "won-

derful Doctor's" reflections above referred to, cannot but be convinced, that he is also entitled to the inventive honors of the microscope. Certainly, many inventions have been awarded on much less obscure grounds, than those on which both telescope and microscope are given to Roger Bacon, the learned and persecuted English monk. But assuming that the microscope thus found its shapely birth in the 13th century, it would seem as though six hundred years ought to have given it a more brilliant future than it has in fact earned.

Perhaps one of the chief reasons is, that the revelations of the instrument, have not, until of comparatively late years, been turned to *practical* use. This is a utilitarian age of ours, and unless a discovery or invention can be made "to pay," it is very apt to be labelled and set aside as of "no account." No matter that this wonderful instrument,—in its scope transcending its twin brother that ranges through regions more distant than geometry has ever measured,—reveals to the inquisitive student a world in every atom, tribes and families of a busy population in every liquid drop, worlds teeming with life and numberless as the stars in the flowers of every garden, and hidden within, beyond all that minuteness which the aided eye of man has hitherto been able to explore, points to the possibility of an undiscoverable region of invisibles; still, men, "busy here and there" in their own daily affairs, have not crowded the gates of this new world, nor cared to realize the magnificent exhibition of Nature's wonders here awaiting them. Had they but made steady explorations in this direction, even for the last century, how much further the world's advance would have been to-day. This untraversed country, like that of the womb of chemistry, is pregnant with a thousand wonders yet to be revealed to our race. And the pleasant thought is, that these gates of knowledge stand open day and night; no passport, save that of an honest desire after truth, is required of those who would enter and explore. Everyone is more than welcomed by those already busy within these limitless fields, and who, like the startled travellers in the granite-walled canyons of the Yosemite, are glad to proclaim to each new comer, the wonders they themselves have seen. This brotherhood in scientific inquiry and exploration, is as beautiful as it is inspiring and productive of great results. And the spirit of it, we would fain impart to our associates and readers;

urging them, as we do, not to be contented merely with "entering into other men's labors," but to gird themselves for individual action, and become enthusiastic participants in this work of wresting from Nature, those marvellous secrets, which sphinx-like, she has, for so long a period, hidden away from the knowledge of men.

It will be the constant aim of this Magazine, to help and serve all such investigators by laying before them continually, the latest theories and discoveries; not only such as are directly ancillary to the all important branches of surgery, medicine and pharmacy; but, also, all and every fact or speculation that widens the field of human knowledge, and draws the curtain from that enchanting world of beauty, which the microscopic key alone unlocks.

This is a rapidly moving age in which we live. Let us possess ourselves of both its energy and activity, and by our individual efforts, help decorate with valuable discovery, the future of the microscope, which, as we have seen, has been so long coming to its royal birth. We long for a vision of its meridian splendor. But when and what shall that be? And who and where is the Prophet to declare it? *

ABSTRACTS.

BACTERIA AND DISEASE.

T. J. BURRILL, PH.D.

(CONTINUED.)

WE must not, we do not by any means ascribe all forms of diseased conditions to parasitism. Our corporeal machinery is altogether too complicated, too delicately adjusted and balanced to run smoothly forever without friction and jars from internal and inherent failings. The vicissitudes of circumstances and of conditions are too varied and vigorous to count for nothing upon our sensitive organism, and the influence of mind on body is by far too great to be passed unheeded as a factor in disease; but we may fearlessly assert without reservation of any kind that all truly infectious and contagious diseases are due to some kinds of parasites.

Each of these maladies has as its immediate cause a living thing distinct from the body itself, capable of independent growth under the proper conditions outside of the body, possessing the

power of self-perpetuation or reproduction and multiplication, endowed with specific characteristics, and animated and controlled by a spark of that same mysterious quality or substance—whichever it is—which distinguishes ourselves from the inorganic, dead clods of earth, the quality or substance known to us as vitality or life. Where this last comes from, and how it is associated with the minute speck revealed by our microscope, science cannot tell. Homogeneous immersion lenses fail utterly to give us instructions in this important particular.

Not all communicable diseases are, however, due to bacteria. Scabies, or the "itch" of the olden time, is in consequence of an eight legged mite; some of the mold-like and yeast-like plants infest, to our discomfort, the human body; trichinæ and numerous other worms are causes of disease, and recently it appears to have been established that malaria is to be charged to the account of minute amœboid animals, making tenements of our blood corpuscles.

But making these and other exceptions, the bacteria may yet be said to be the disease producer, the parasites of contagious diseases, as well as many maladies not considered communicable. Whether tuberculosis (consumption) is always directly derived by contagion is not settled, though that the morbid processes are due to *Bacillus tuberculosis*, a specific and now well-known organism, ought to be universally accepted. The statistics of the hospitals do not yet show that this disease increases in consequence of the admittance of tuberculous patients.

Whether or not tuberculosis as it exists, always passes directly from the diseased to the healthy, it is positively a virulently contagious malady, and the sooner this is recognized the better for human life and sanitary science. The disease can at any time be communicated by inoculation to healthy animals, and this from strictly pure cultures of the specific microbe. Keep this latter strictly away and we shall suffer no more from the peculiar and dreadful scourge which now inflicts such untold misery upon our race. As we come to know more about the various methods by which the virus is conveyed, we shall be better able to escape its contagion. It is now thoroughly demonstrated that tuberculosis may be conveyed through the food, a method, no doubt, which has obscured the real contagious character of the disease.

We are also speedily coming to recognize that all acute suppurative processes are chargeable to bacteria. What an era of progress in surgery is this of our day! What inestimable blessings to the maimed and unfortunate have come since Lister first experimented with his cleansed instruments and antiseptic dressings! What needless pain has been spared and how many lives have been saved by the progress in surgery since the memorable date of 1865!

An operation (ovariotomy) which previous to that time was considered well nigh fatal, and twenty per cent. of deaths in spite of the highest attainable skill occurred, has been performed one hundred and thirty-nine times in the two years, ending December, 1885, without a single death, by Lawton Tait, of England; and others are having almost as marvelous success. It used to be said when skin eruptions occurred, when boils, felons, abcesses, carbuncles, etc., affected the suffering, that "the blood was out of order," and various and powerful were the prescriptions therefor. Perhaps the most of us can remember the regular sulphur and molasses treatment every spring time to dissipate the evil accumulations of inactive winter. Even now it is supposed by many that irritants, like croton oil, applied to the skin produce suppuration, but investigations show that in none of these and similar instances is pus formed without micro-organisms as the true agents.

Again we have come to understand that many diseases not commonly conveyed from the sick to the healthy are directly connected with the food and water consumed. Multitudes of cases are on record where sickness has been attributed to canned vegetables, preserved meats, fish, milk in various shapes and methods, edible mushrooms, etc. Statistics gathered in Swabia show in half a century four hundred cases of sickness and one hundred and fifty deaths from sausage poison, presumably not trichinæ. An epidemic in the Volga district that spread terror throughout Europe a few years ago was traced to the preserved fish used as their almost entire food. Abundant examples are furnished in our own country in every community. Last year numerous cases of poisoning by cheese were reported in Michigan, and now similar word of like effect reaches us from the use of ice cream. Recently in Wilhelmshaven, a seaport town of North Germany, a large number of people were made sick after eating edible clams

taken from the waters of the harbor into which was poured the sewage of the city. Several deaths occurred. These mussels taken from pure water are perfectly acceptable articles of food, but those from the sewage contaminated areas were found to be virulently poisonous, killing rabbits in from two to ten minutes. These and similar results are due to the microscopic living agents of fermentation and putrefaction, either by their direct action when taken into the stomach, or through the accumulations of poisons produced by them in the decomposing materials. Milk is peculiarly liable to fermentative changes and so dangerous as food when improperly handled. Let it not, however, be understood from this that all fermented products are necessarily unhealthful. It is only when certain specific changes take place that danger exists. It behooves us to find out what and why. But the most dangerous of such contaminations are those finding their way into drinking water, and among all the deplorable records in the tables of sanitary science are those of typhoid fever, certainly a parasitic disease, and almost wholly communicated through the agency of water.

It is stated that there are, in the United States, twenty-five thousand deaths annually from this wasteful disease, representing one million, five hundred thousand cases. The one million, two hundred and fifty thousand, who recover, lose at least six weeks from the activities of life, besides the care entailed upon attendants, and the miseries of the sick chamber.

If we count the loss in money by reason of incapacity of the sick to labor, and the expense of attendance together at one dollar per day, we shall have for those who survive an aggregate annual financial loss of $52,500,000,000, all of which ought to be avoided. Possibly our present knowledge is not sufficient, even if rationally and carefully used, to fully extirpate this appalling malady; but we are positive that the great highway to further information is competent to reach the merciful end. In Philadelphia last year there were reported six hundred deaths from typhoid fever — from at least three thousand cases—upon which an editor of a medical journal remarks: "It would seem that no more effectual method could be devised for the generation and introduction of noxious gases than exists even now in thousands of houses in this city." The violent epidemics of this disease in Brooklyn, N. Y., and of

this or something similar in Plymouth, Pa., are well remembered.

In my own town, of ten thousand inhabitants, a small, open stream of water, almost failing in mid summer, receives the sewage and filth, inevitably collected in its course through the suburbs of the place. Cows are permitted to run at large upon the wide open commons and to drink at will from this polluted water. No evidence is now needed that milk from cows drinking the water carrying the germs of typhoid fever, may communicate the disease. This is an incontestable fact. Sometime, I fear, when it is too late, our people will recognize the awful danger that attends a risk of the kind now pointed out; and yet our state board of health rates the town among the best in its sanitary condition.

Third. How do bacteria cause disease? In all this talk about bacteria as disease agents, we are apt to think of them as specially distinct and different from all other living things, perhaps as endowed with some venomous properties like poisonous snakes among animals. But the fact is, these microscopic organisms are simple plants, living and dying, growing and multiplying, under conditions as circumscribed and laws as immutable as those which limit and govern other vitalized beings or things. They are far removed from anything that can be called malicious. They heed not the ruin wrought, but obeying the impressed law of vegetative growth simply, and only appropriate suitable food when and where it is supplied to them. Having no means of locomotion except on a microscopic scale, and this only in the case of certain species, they are subject, as to distribution, to the natural forces of air and water currents, gravitation, or the movements of other living things. They are destroyed by heat, in their vegetative condition never surviving that of boiling water continued some minutes, (as spores, resisting somewhat higher temperatures for longer periods,) poisoned by various chemical substances, and die at length from exposure and starvation. The bodies of living plants, animals and men are by nature carefully protected against these unarmed foes, by an epidermis or skin, usually impenetrable by them; by specially and wonderfully constructed guards, to prevent their entrance to vulnerable openings, as the hairs moistened with mucus in the human nose, the moistened, vibrating cilia of the epithelial cells lining the road to the lungs. They are checked or entirely overcome by the natural secretions, like the etherial oils in plants (per-

haps here for that very purpose), the acids of the stomach, and the strongly antiseptic bile of the liver in animals; or, finally are beaten in the struggle for existence by the peculiar powers of vital resistance possessed in greater or less degree by all living things, plants as well as animals, man as well as bacteria.

Against such defences and barriers our minute, simply constructed, senseless bacteria must make their way if they are going to gain their own sustenance from living plants or animals. The fact is that most kind of bacteria are never able to overcome these vital barriers.

We hear it said, bacteria can not be the cause of disease, since they are about us and within us in great numbers in our best states of health. As well might be said, animals will not eat flesh, since we know great pastures full of flocks and herds that cannot be made to touch it as food. Most species of bacteria are confined to a regimen of dead organic matter. They riot in the carcass of a dead animal that they were wholly unable to injure in the living state. Other species, still greater in number than those to be next mentioned, manage to grow and multiply on or in living things only when the ramparts of the latter are broken down, when the defences are weakened, when the ebb and flow of the vital current is by other means reduced or deranged. Bacteria that without help can not get through the skin upon one's arm, may readily do so by the aid of croton oil or cantharides. Those which ordinarily cannot stand the ordeals of the stomach, may do so in cases when the latter fails to excrete its normal juices by the untoward influences of unhygienic food.

Finally, certain species much fewer in number than the preceding, seemed to have powers of invasion altogether surpassing the defences normally offered by many individuals. These are the organisms of true contagions, like small pox, scarlet and yellow fevers, measles and cholera. Yet even with these last the struggle is ever going on. In the worst epidemics certain persons remain unharmed, not because the disease producers are not wanting, but because their physiological activities are more than matched by those of the exempt party. And the same person may offer far greater resistance to these destroyers at one time or in one condition than at, or in another, just as he may against every other influence or thing. Let a man, not accustomed to hard labor in the

sun, go into the meadow and attempt to swing a scythe all day and what will be the probable result? Let him of the north, change his habitation in summer to the tropical south, what may we expect?

Without further discussion we may say that certain kinds of bacteria cause disease by invading, against the provided defences, the bodies of animals or plants, and by physiological activities peculiar to themselves, disturb those of the invaded or parasitized hosts. In some cases their detrimental influences are mainly mechanical. By multiplying and collecting in great numbers they form plugs in the blood vessels and impede the circulation. By similarly collecting in the air passages, suffocation may follow. Others, like the bacilli of tuberculosis, and typhoid fever, after gaining lodgement in the body, have a corrosive action by which the substance of the tissues is modified or destroyed, while still others give rise to chemical changes inimical to health. It has been found in certain cases, without, as well as within the living body, that organic compounds called *ptomaines* are formed (through the decomposing activities of special organisms), having physiological properties similar to those of the alkaloidal poisons. There is surely nothing surprising in this. The alkaloidal poisons like atropine and strychine are products of plant physiology. Should we wonder that among the multitude of chemical changes set up by bacteria in organic bodies, some of these should result in poisons as deadly as those secreted in other plants? More recently it is announced that poisons are manufactured in the chemical changes produced by the forces of the living body itself. To distinguish these the name *leucomaines* has been given them by Gautier, their discoverer. Here again there is to my mind nothing improbable or contradictory to former thought. Green plants develop poisons, bacteria develop similar poisons as organic compounds; why need we wonder that we ourselves having wonderful vital powers over chemical changes may in some conditions and circumstances also give rise to poisonous products?

What concerns us most is that the poisonous ptomaines may be produced in materials intended for human food, and thus make untold mischief and suffering. A case of this kind undoubtedly occurred in the dried beef poisoning reported to this society last year by Dr. Detmers.

Fourth. How may diseases due to bacteria be avoided? It is to the answer of this practical question that the great and chief interest in investigations upon pathogenic bacteria is attached. Most people care little for the minute organisms themselves. They would rather never have any introduction or form anything like a practical acquaintance with them or their effects. How are we to escape? is the cry. Would that the cry were louder! Happy for the human race when the danger is rationally apprehended—when men are aroused to the importance of intelligently strengthening and assisting their natural defences, of directly and skillfully combatting revealed and comprehended enemies, of scientifically and thoroughly protecting themselves! It can be done!

What has been accomplished within our memories gives a basis for abundant faith that much more is to be done. Man, not microbes, is to have dominion! We can only glance at the possibilities within our reach, at the accomplishments achieved. In the first place, it must be recognized that a knowledge of the cause of a disease is a great step towards prevention or cure.

One may occasionally accomplish something, fighting in the dark, striking at unseen foes, but it is awkward business, at best and usually futile in result. The enemy once found, his habits and methods discerned, conquest may be assured and victory easy. It is fully time that we accept the parasitic doctrine of disease, that we believe in the revelations of our microscopes, that we recognize in bacteria and their allies the sought for enemies and that we marshal our forces against them.

When those whose professional business it is to deal with disease unite upon this ground, and together, in solid agreement, help in the struggle, we shall make rapid advances toward the victory prophesied.

(To be continued.)

TUBERCLE-BACILLI IN THE URINE. Dr. Kirstein reports in the *Deutsche Med. Wochenschrift*, (Sept. 15, 1886), the clinical history of a case of grave septic cystitis in which, by the discovery of the tubercle bacilli in the urine, he could diagnose the simultaneous existence of tuberculosis of the bladder. The copious sediment, consisting chiefly of purulent and septic matter, rendered the recognition of the bacilli extremely difficult. They could only be found in one out of forty slides. To facilitate the finding of the

microbe, Kirstein proposes the following procedure: The sediment is transferred to a cup-shaped glass, well stirred with a glass rod and filtered; then the residue is poured on a watch glass, some of the matter crushed between two slides, and treated in accordance with Ehrlich's method. The result of this procedure was the finding of the bacilli in each of the preparations thus obtained.—*Therapeutic Gazette.*

GIGANTIC SEAWEEDS.—Some of the gigantic seaweeds have stems which exceed in length any of which terra firma can boast. Recently the ship "Clever," commanded by Capt. John Stone, arrived at Montevideo with a portion of a seaweed which had been picked up in the Atlantic near the equator. The sailors perceived an object floating on the surface some distance from the ship, and, manning a boat, they rowed to it, and ascertained that it was an alga of enormous size. On measuring it, it was found to have a length upward of fifteen hundred feet. It has been identified by botanists as Macroceptis pyrifera.

S. BATTONE, writing to the *English Mechanic*, says that he finds that the price charged by the English workmen for the delicate and accurate brass work of a microscope is generally equal to the entire charge for the complete instrument abroad. If, however, the purchaser be contented to pay the tip-top prices of the best English makers, he may be sure of obtaining an instrument which will fear no rival. The disparity in the prices of labor and food in England and the Continent accounts for the difference in the cost of a good of microscope.

METHOD OF STUDYING BLOOD PLACQUES.—*Bizzozero's Solution:* Concentrated aq. sol. of methyl-violet, one part; three-quarters per cent. sol. of sodium chloride, 5,000 parts.

Hayem's Solution.—Mercuric chloride, ½ gm.;
Sodium Chloride, 1 gm.;
Sodium Sulphate, 5 gm.;
Water, . . . 100 c. c.

Osler uses a one per cent. sol. of osmic acid.

Cleanse the finger carefully, and place a drop of one of the above solutions on it. Puncture the finger with a fine needle through this drop, so that the escaping blood comes in direct contact with the solution. Mix thoroughly and mount.—*Reference Handbook, Medical Sciences.*

THE BACTERIA OF GRANULATIONS.—At a recent meeting of the Paris Surgical Society, M. Poncet stated that the bacteria of granulations were studied in 1881 by Sattler. M. Poncet detected in an eye enucleated by M. Delienne, the presence of a micrococcus in the interior and exterior of the granular cells. This investigator also found it in the membrane of Descemet, and in the iris. M. Poucet considered it possible that the micrococci had penetrated into the anterior chambers in consequence of an incision, for iridectomy had evidently been performed. M. Poucet showed drawings representing the position of the micrococcus in the granulation.—*British Med. Journal.*

ACTION OF THE STOMACH UPON FUNGI:—Dr. Müller of Austria, has been making some extremely valuable observations on the action of the stomach upon fungi. Inasmuch as one of the common methods by which zymotic diseases are believed to be produced is by the introduction of their germs into the alimentary canal, it can readily be seen that this investigation is replete with interest and importance. He finds that if these fungi, as, for instance, bacilli and bacteria, are introduced at the beginning of a meal, before the hydrochloric acid of the gastric juice is poured out by the stomach glands, they pass on to the intestine uninjured. If, however, they are taken into the stomach at a later time, when the reaction of the stomach is acid they are destroyed. It has been satisfactorily demonstrated by numerous observations that persons were likely to contract cholera when the stomach was diseased, or, as is commonly said, "out of order."—*Science.*

THE BACILLUS OF TYPHOID FEVER.—Neuhauss has continued his study of the contents of the roseola spots of typhoid, and, as before, finds in the blood obtained therefrom a characteristic bacillus. Only the blood from these spots contains the bacilli, a fact which inclines him to the opinion that the cutaneous lesions are due to "bacterial emboli." In nine out of fifteen cases he has succeeded in making cultures of the typhus bacillus from blood thus obtained. The author, moreover, claims also to have found the bacilli in the fœtus of a woman who aborted soon after a relapse of typhoid fever.—*Centralbl. f. Klin. Med.*

THE MICROCOCCI OF VACCINE.—Voigt has separated and cultivated in gelatine three kinds of micro-organisms all of which liquify the medium.

1. Small cocci which, near the surface of the gelatine, form grayish-white sharply defined spherical colonies, the periphery being of a pale yellow color. Under a high power they appear to possess a proper movement, and occur in knots of two and four. These are probably the carriers of the contagion.

2. Large cocci which form pale green spherical colonies with rough and indefinite surfaces, and under a high power show only slight Brownian movement. These were not always present.

3. Small cocci in gray, yellow, dark, sharply defined colonies with a delicate cloud in the neighborhood, presenting, under a high power, groups of two to four, but possessing no separate movement. In stained preparations they are not distinguishable from (1), but are ineffective for vaccination. Three out of fourteen calves were successfully vaccinated with (1).

PHENOMENA OF THE DIVISION OF THE CELL-NUCLEUS.—M. L. Guignard directs attention to some of the phenomena which accompany the division of the nucleus of the cell, with especial reference to the theories of M. Degagny. That botanist teaches that the nuclei disappear progressively as the equatorial zone becomes colorable. This is denied by M. Guignard, who points out that the coloration of the equatorial zone is due not to nuclei, but rather to the cystoplasmic granulations, which play an important part in the formation of the cellular plate, and of which M. Degagny makes no mention. The figured element must not be confounded with the amorphous nuclear fluid; methyl-blue is not a suitable substance for differentiating the elements which enter into the constitution of the nucleus or of the cell.—*Royal Mic. Jour.*

NEWS AND NOTES.

JAPAN is to have a marine laboratory at Miski, Sagami.

A NEW Journal, *The American Journal of Biology*, edited by H. D. Valin, M. D., is announced for publication in Chicago.

THE July *Journal of the New York Microscopical Society*, contains two excellent full page artotypes representing five species of *Triceratium.*

IT is claimed, that, whenever an acute abscess forms, two varieties of micro-organisms will invariably be found in the pus,—Staphylococcus pyogenes and Streptococcus pyogenes.

PROF. SASAKI, will have a memoir on the maggot parasite of the silk worm, in the first number of the journal to be published by the College of Science, Imperial University, of Japan.

A MARINE and fresh water observatory has been established at Lochbuie, Isle of Mull, a station which promises to yield useful results in connection with the movements of the Salmonidae and herrings. The establishment is under the direction of the National Fish Culture association.—*English Mechanic.*

E. HECKEL and Fr. Schlagdenhauffen have detected the presence of the decomposition products of lecithin in a number of vegetable preparations. These facts establish a new link between the animal and vegetable worlds. They confirm once more the great truth of the vital unity proclaimed by Claude Bernard, to which is now added the unity of evolution and of organic composition.—*Chemical News.*

IN order to prevent the curling up of the legs of Dermanyssus while mounting, J. C. Thompson obtains the animal alive, and allows it to walk on a slide. While in motion a tolerably cool drop of glycerine jelly is allowed to fall on it, and whilst it is "trying to grasp the situation" with *all its limbs extended*, drop the warm cover on, and on examining when cool the object will be found to be well displayed, color natural, and no air bubbles.—*Jr. Microscopy.*

THINK you, that what is carelessly looked upon by the uninitiated as a mere snow flake, does not suggest higher associations to one who has seen through a microscope the wondrously varied and elegant forms of snow crystals? * * * * * Whoever at the seaside has not had a microscope and aquarium has yet to learn what the highest pleasures of the seaside are.—*Jour. Science and Art.*

MR. J. D. BECK furnishes this item in regard to the mounting of pollens: "Pollen may be mounted dry and in any desirable medium on the same slide, as follows:—Spin a ring of the medium on a slide with a sable brush, from one-sixteenth to one-eighth inch wide, so that it will be covered by the cover glass. Charge the cover glass with the pollen and press down gently. The pollen in the middle will be dry while that around the edges will be in the medium."

AFTER receiving a specimen of *trichinæ* pork from the president of the Pennsylvania State Board of Health, the *Anti-Adulteration Journal* submitted twenty-five samples of pork, obtained of dealers in Philadelphia, Camden, N. J., Germantown, Williamsport, Lock Haven, Pa., Pittsburg, Wilmington, Del., Baltimore, and New York, to the microscope, and found that six of the specimens contained the *trichinæ spiralis*. These samples were taken from the largest and healthiest appearing hams. "We are convinced," says this journal, "That trichinosis is on the increase, and that increased watchfulness is necessary to avoid the contamination and death incident to eating diseased pork."

BOOK REVIEWS.

COCAINE IN HAY FEVER, by Seth H. Bishop, M. D. Reprint.

REPORT ON THE BILOXI FEVER, Louisiana State Board of Health. Reprint.

INTUBATION OF THE LARYNX FOR DIPHTHERTIC CROUP, by E. Fletcher Inglas, A. M., M. D.

OPERATIONS ON THE DRUM-HEAD FOR IMPAIRED HEARING, with fourteen cases, by Seth S. Bishop, M. D. Reprint.

BUTTER VS. OLEOMARGARINE. A speech by the Hon. Warner Miller, of New York, in the United States Senate, Washington.

OBSERVATIONS ON THE USE OF SOME OF THE NEWER REMEDIES IN DISEASES OF THE UPPER AIR-PASSGGES. BY E. L. SHURLY, M. D. Reprint.

AN Address delivered before the Alumni Association of the Department of Medicine and Surgery, University of Michigan, by Chas. J. Lundy, A. M., M. D.

A RECORD FOR MICROSCOPICAL SUBJECTS.—Mr. Chas. E. Alling, of Rochester, N. Y., has sent us a sample sheet of a book for listing microscopical specimens which cannot but recommend itself to all microscopists, and which will supply a much needed want. We heartily recommend the book, and think the arrangement good in every respect. The price is within the reach of all.

THE GAPE WORM OF FOWLS, ETC., by H. D. Walker, M. D. Dr. Walker seems by his researches to have proven beyond dispute that the parasite producing gapes in chickens needs some intermediate host in which to pass a certain period of its existence before developing in the chick. This host he finds to be the common earthworm (*L. terrestris*). This subject has long puzzled observers, but is now, we believe, fairly settled by Dr. Walker's interesting and valuable investigation.

EXCHANGES.

(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.)

POLLEN and Vegetable slides double stained (new method) 50 cts. each. Slides and formulæ of new stains etc., 75 cts. each. A large variety of pollen, 5 cts. a package..
J. D. BECK, Liberty, (Tioga Co) Pa.

WANTED—A Milliampermeter in exchange for cabinets slides or cash.
CHAS. BLASDALE, M. D,. Jericho, Queens Co., N. Y.

SLIDES, labels for same and material in exchange for slides.
EUGENE PINCKNEY, Dixon, Ill.

WANTED—Microscope of modern make, Bausch & Lomb Investigator preferred. Also Foraminifera Polycistina. Will give fine slides or cash.
E. H. RICHARDS, Woburn, Mass.

WANTED—Good Zentmeyer Microscope Stand, Binocular preferred, none but a first class instrument. M. DE BALD, 136 Goodell St., Buffalo, N. Y.

FOR EXCHANGE.—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially desired
ROBT. W. WOOD, JR., Revere St., Jamaica Plain, Mass.

FOR EXCHANGE.—Mounted sections of injected lung of guinea pig.
CHAS. BLASDALE, Jericho, Queens Co., N. Y.

FOR EXCHANGE—Mound builders relics, pottery fragments and Indian relics for medical books and surgical instruments. DR. HENRY W. COE, Mandan, Dakota.

FRESH WATER ALGÆ, very numerous species, including Volvox in abundance, Desmids, of all kinds, Draparnaldia, Rivalaria, Anabaena Tetraspora &c., &c.
J. M. ADAMS, Watertown, N. Y.

DIATOMACEOUS Earth from Denver, Col.. in exchange for mounting material.
H. B. CHAMBERLIN, box 1597, Denver, Col.

I HAVE for exchange Stellate Hairs of Plants, Pollen, and Seeds ; also various Diatoms, Polycistina, etc., and a variety of other good objects, all well mounted.
W. FARNELL, Macon, Ga.

FOR SALE.—A copy of Prof. Leidy's great work on the Rhizopods has been left at this office for sale. Price, $7 50. C. H. STOWELL.

I WILL exchange good histological for other first-class mounts.
S. G. SHANKS, M. D., 547 Clinton Avenue, Albany, N. Y.

ACARI INSECTS, pathological and other well mounted slides, in exchange for Pleurosigma, Trichina, Diatoms, Stained Bacteria, etc J. O. Stillson, Indianapolis, Ind.

AMPHIPLEURA PELLUCIDA, or any other test diatom, mounted in the new medium having refractive index of 2, 4, can be procured from H. H. CHASE, Geneva, N. Y.

DIATOMACEOUS Clay from this place and slides of Foraminifera and Diatoms to exchange for fine slides or material. E. H. RICHARDS, Woburn, Mass.

WANTED.—Unmounted material of any kind ; foraminifera and diatoms preferred ; will give good exchange. M. A. BOOTH, Longmeadow, Mass.

FOR EXCHANGE—Cathcart's ether freezing microtome, complete. Would prefer an injecting syringe. A. B. AUBERT, Orono, Penobscot Co., Maine.

WANTED—No. 5 of Vol 2, and No. 1 of Vol. 3. This journal. Who can supply ?
D. HUMPHREY. Lawrence, Mass.

FOR EXCHANGE—A new mechanical finger for a copy of Beale or Carpenter ; slide of grouped diatoms for French objective, ¼ inch in focus
HAROLD POLWE, 136 High St., Peoria, Ill.

WANTED—Complete or partial set of Woodward's photo-micrographs ; also to exchange, photo-micrographs of various objects ; a list of which will be sent on application JAS. B. SHEARER, Cor. Center & Adams Sts , Bay City, Mich.

WANTED—Gross', Erichsen's, or Bryant's Surgery, last edition, in exchange for a 1 in Spencer objective, turn-table, Walmsley pattern, or Microscopical books.
Address, Box 213. Fayetteville, N. Y.

FOR EXCHANGE.—Pathological and Histological Specimens (mounted and unmounted), in exchange for good slides.
FRANK M. HOYT, 160 Washington Park, Brooklyn, N. Y.

FOR SALE.—A Bulloch "Biological" Microscope Stand in Case. with two inch and one inch Huygh. Eye-pieces, the latter made by Tolles. Has extra glass rotating stage, graduated draw-tube, graduated sub-stage and mirror bars, and adapter in draw-tube. Price. $35.00. A. L. WOODWARD, 55 Lansing St., Utica, N. Y.

WELCOME LIBRARY INSTITUTE

THE MICROSCOPE.

VOL. VI. DETROIT, DECEMBER 1886. No. 12.

ORIGINAL COMMUNICATIONS.

MICROSCOPICAL NOTES.

SIMON H. GAGE.

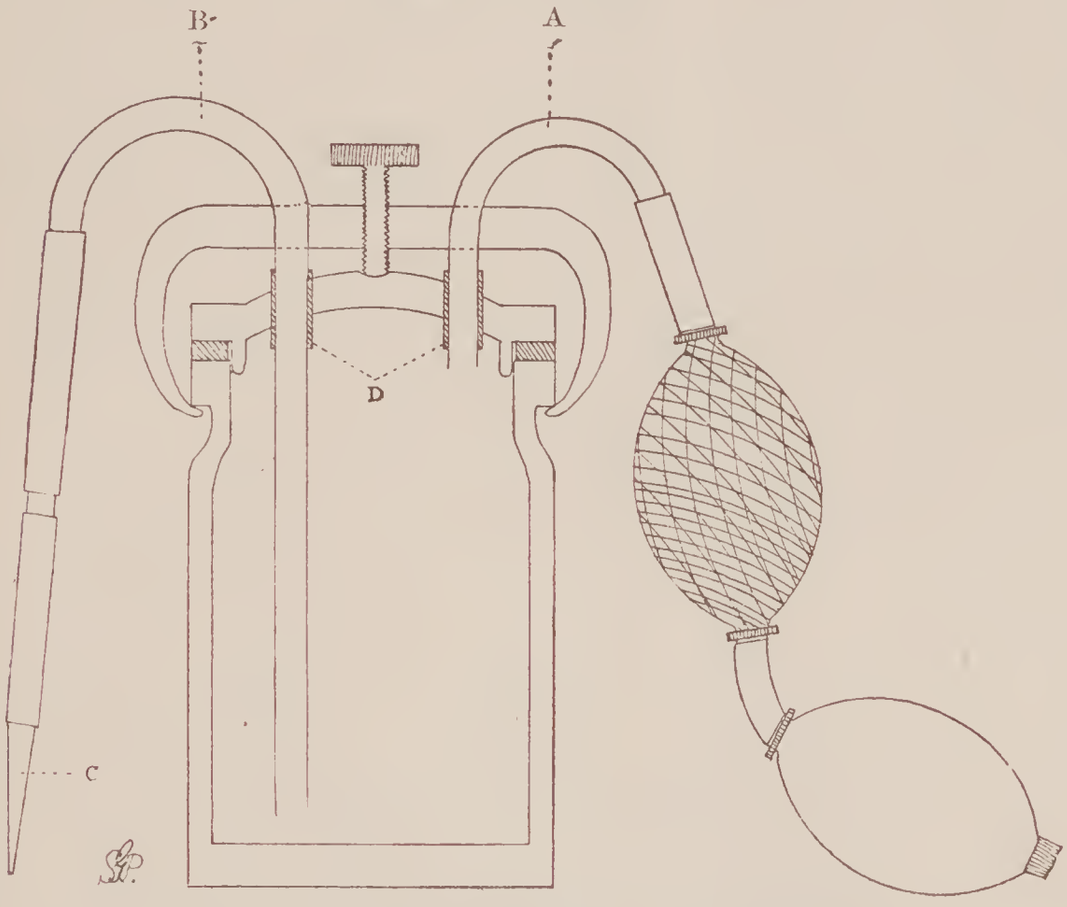


FIGURE 1. INJECTING JAR. A. Glass pressure tube just penetrating the cover of the jar and connected with the atomizer bulbs by rubber tubing. B. glass delivery tube passing through the cover and extending nearly to the bottom of the jar. To this is attached the cannula. C. Injecting cannula, terminating the delivery tube. D. Rubber tubing serving to make the joints air tight where the tubes penetrate the cover of the jar.

1. INJECTING JAR. The preparation of the injecting jar here figured grew out of the necessity of some simple and efficient apparatus for injecting liquids (chloride of gold, nitrate of silver, nitric, chromic, osmic and picric acids) which would be injured by or injure an ordinary syringe. As will be seen by a glance at the figure, the injecting jar is made on the principle of an ordinary wash bottle. It is prepared by boring two holes in the glass cover of a fruit jar or of an anatomical specimen jar, and inserting glass

tubes, the pressure tube just penetrating the cover and the delivery tube extending nearly to the bottom of the jar; (Fig. 1) where the glass tubes penetrate the cover they are surrounded by rubber tubing to render the joints air tight. The pressure is obtained by the use of an atomizer bulb, or, in order that it may be constant, two bulbs are used, the second one being covered with a net to prevent undue distention. The bulbs used with ether-freezing microtomes or with some form of thermo-cautery are good, but two thick walled atomizer bulbs are just as efficient.

The delivery tube and the cannula are of glass, only enough rubber tubing being used to make the delivery tube outside the jar flexible. While this jar was designed for special liquids, it has been found excellent for making fine injections with gelatin mass. With two bulbs, as in the figure, a pressure of 40 mm. of mercury may be obtained; this is sufficient for most purposes. While water or mercury might be used to obtain the pressure as in the various forms of constant pressure apparatus, the atomizer bulbs are preferred, as it is easier for the operator to control the pressure and adapt it to the individual cases.

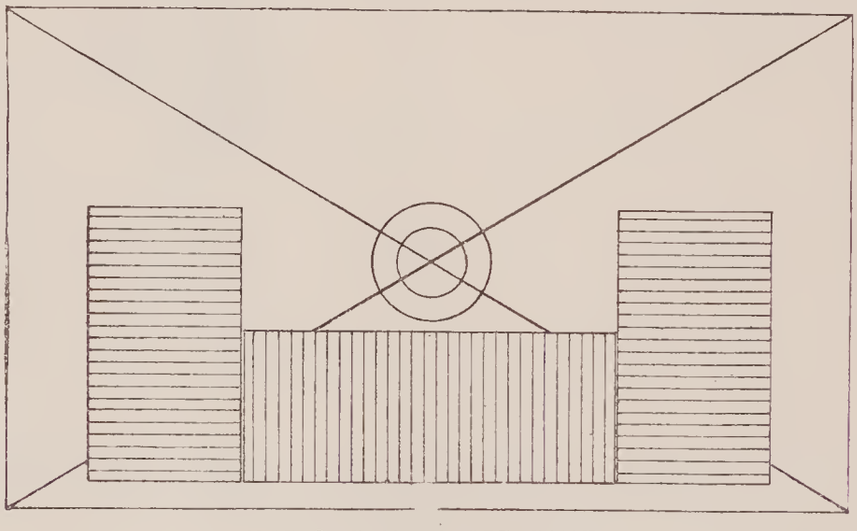


FIG. 2. CENTERING CARD.

2. CENTERING CARD. In mounting objects in balsam or in glycerin without a cell it is somewhat difficult to get the specimen in the center of the slide. It is very easy, however, if the slide is placed upon a card like that shown in the figure (fig. 2). The card is prepared by making upon it several concentric circles, and then cementing to it pieces of glass or Bristol board, so that when the slide is placed in position the center will be over the center of the circles. This device does not enable one to increase the excellence of a preparation, but it does enable one to render the

specimen more attractive to the naked eye and that too without expenditure of extra time.

3. PERMANENT CAUSTIC POTASH PREPARATIONS. It is usually stated that specimens treated with caustic potash cannot be permanently preserved. During the past summer an aqueous solution of caustic potash of thirty-five to forty per cent. was used for isolating cardiac muscle from many different animals; as some of the preparations were drawn it seemed unfortunate not to be able to render them permanent as vouchers for the drawings. This was accomplished by adding glacial acetic acid to the isolated cells. The acid combines with the caustic potash to form acetate of potash, which is often used for permanent mounting; finally a mixture of glycerin seventy-five parts and an aqueous solution of picro-carmine (one per cent.) was added as a permanent mounting medium. These specimens after three months show no signs of deterioration. If the specimens were already under the coverglass, a drop of glacial acetic acid was drawn under it and afterward a drop of the glycerin and picrocarmine mixture.

4. PAPER FOR CLEANING THE LENSES OF OBJECTIVES AND OCULARS. For the last two years the so-called Japanese filter paper (the bibulous paper often used by dentists when filling teeth) has been used in the laboratory for cleaning the lenses of oculars and objectives, and especially for removing the fluid used with immersion objectives. Whenever a piece is used once it is thrown away. It has proved more satisfactory than cloth or chamois, because dust and sand are not present; and from its bibulous character it is very efficient in removing liquid or semi-liquid substances. At the writer's suggestion it was tried in the Bureau of Animal Industry at Washington, and is now used there almost exclusively for the purpose named above.

5. DEMONSTRATION OF THE FIBRILLAE OF UNSTRIATED MUSCULAR FIBERS. For demonstrating the longitudinal fibrillation of unstriated muscular fibers the following method has proved very satisfactory: Ten to fifteen cm. of perfectly fresh small intestine from a cat or other animal is tied at one end and into the other is injected (with the injecting jar, see fig. 1.) the following mixture: ninety-five per cent. alcohol, twenty-five cc., water seventy-five cc. picric acid crystals three-fourths of a gram. When the intestine is

moderately distended the end in which the injection is made is tied and the piece of intestine placed in a glass dish and covered with the mixture. After one or two days the muscular coats may be torn off in shreds. If one of the shreds is teased well with needles, unstriated muscular fibers may be partly or wholly isolated. They may be mounted in seventy-five per cent. glycerin. The picric acid stains the fibers yellow and with a homogeneous immersion (1-12th or 1-18th) the longitudinal fibrillation shows with the greatest clearness. In some cases the ends of the fibers will be frayed and show the fibrillae something like a brush.

ANATOMICAL LABORATORY OF CORNELL UNIVERSITY.

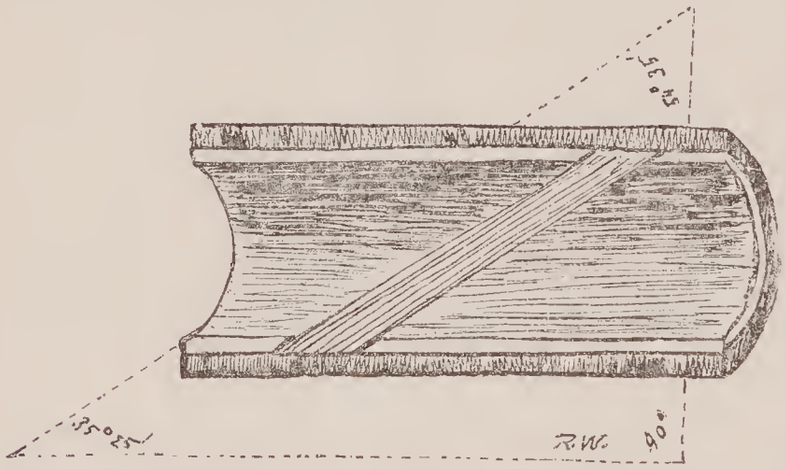
November 1, 1886.

A SIMPLE POLARISCOPE.

R. W. WOOD, JR.

FOR the benefit of those whose financial state is such as to prevent the outlay of fifteen or twenty dollars, for a first-class polariscope, I will give a few hints for the manufacture of one at the modest price of fifteen or twenty cents.

As microscopes differ in build it will be useless to give any very explicit directions, and I shall simply describe the method by which I made mine, trusting to the ingenuity of the reader to modify the construction to suit his or her instrument.



The polarizer is nothing more than a piece of black glass (glass backed by a black, enamel-like varnish) substituted for the mirror.

If your mirror is single, cement the black glass, cut to the proper size, to the back; if double, attach the plate so that it can be removed at pleasure.

The analyzer requires more care and must be adapted to the microscope.

My microscope tube unscrews about half way down or in other words "Breaks in two in the middle."

I made a paper tube, with a wall $\frac{1}{8}$ of an inch thick, which

would fit snugly into the upper tube of the microscope, by winding a strip of thick, unwrinkled, brown paper, two inches wide, around one of the brass cases or objective boxes, pasting it carefully as I rolled it. After letting this dry for an hour or two I removed the brass cylinder and made another tube to fit into tube No. 1 by winding the paper around a big pill bottle.

By means of a razor I divided the smaller tube diagonally at an angle of 35° 25′, inserting the bottle to prevent it from collapsing.

After blackening the tubes, I procured 18 circular (elliptical are the best) cover glasses having the same diameter as the larger tube, which, after cleaning and polishing *very* carefully, I placed in the large tube so as to be supported at an angle of 35° 25′ by the oblique surfaces of the small tube.

The analyzer is now complete, and if you have succeeded thus far, you can proceed to try it.

Place the analyzer in the tube of the instrument, and, setting the polarizing plate at an angle of 54° 35′ with the stage, stand the microscope on a table six or eight feet back from a window.

Tip the body of the instrument up and down, until the light reflected from the polarizer passes through the tube, and then examine with your lowest power, some very thin slivers of the mineral selenite.

It will probably be some minutes before you get good results, but if all goes well you will see a beautiful mosaic of colours.

Rotate the part of the microscope containing the analyzer and each tint changes to its complementary colour.

The comparatively small amount of light reflected by the polarizer renders the use of high powers impossible. However, most of the common polariscopic objects as starch grains, chemical crystals, &c., show to good advantage.

The accompanying diagram shows the analyzer in section, together with the two angles necessary in the making of the apparatus.

NEW INVENTIONS.

A SLIDE CARRIER.

MR. B. T. QUIMBY of Chicago, has invented a slide carrier which is particularly adapted to the Griffith club microscope, but

may be used with any instrument having straight stage clips. This carrier is exceedingly simple in its construction,—consisting of two thin pieces of wood rather larger than a slide, with a round hole piercing their centre. Narrow strips of sufficient thickness are fastened between the top and bottom pieces, dividing the interspace into three compartments,—into the middle of which a square of blue glass may be inserted, while the end spaces are for the clips. In the upper surface of the carrier, behind, is a ridge to prevent the slide from slipping down while the microscope is at an angle. We have tried this convenient little device on one of Mr. Griffiths' instruments, and find that it is a decided addition. Mr. Quimby states that he has found the carrier of special use in holding a Wenham's compressor, which is not easily managed with the clips alone. This universal carrier will be appreciated by microscopists.

PROCEEDINGS OF SOCIETIES.

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

SEPTEMBER 8, 1886.

THE regular fortnightly meeting of this Society was held at the Society's rooms, Dr. S. M. Mouser presiding.

After the routine business had been disposed of, the Secretary exhibited some specimens of "jasperized" wood, from the petrified forest at Chalcedony Park, A. T. This material, by reason of its extreme hardness and great beauty, is beginning to be extensively used in the manufacture of jewelry and for various ornamental purposes. Under the microscope, the woody fiber with its characteristic markings, was seen to be perfectly preserved. In fact, it is in many cases possible to determine not only the genus but even the species, by a microscopical examination. In the specimens which were examined, some chalcedonic concretions of unusual regularity and beauty, attracted much attention.

Some exceedingly minute "jumping seeds" from Calaveras county, each probably containing an insect larva, were shown by the President and referred to Dr. Bates for further examination.

A number of very handsome slides of Algæ and Foraminifera, mounted by A. Durrand, F. R. M. S., who was present as a visitor, were examined with much interest.

The advisability of giving the annual exhibition during the ensuing month was discussed, and the matter was referred to a committee.

SEPTEMBER 22, 1886.

The committee appointed at the last meeting to examine into the advisability of holding the annual reception next month, reported strongly in favor of the proposition, and after some discussion it was unanimously decided to hold the reception on the 16th prox., provided a suitable hall could be obtained for that date. From present indications there is scarcely a doubt that as regards the number of exhibitors, the number of microscopes used and the variety and beauty of the objects shown, the coming exhibition will be the best ever held on this coast.

Pursuant to announcement Dr. Stallard delivered a brief address on "Endarteritis," or morbid development and subsequent degeneration of the interior coat of arteries. The structure of the three layers of tissue of which arteries are composed was described in detail. The interior coat, it was explained, was most liable to become morbidly affected. When the blood is forced through an artery at an abnormal velocity the interior layer manifests a disposition to resist the increased pressure by thickening, and should the pressure be of long continuance it frequently results in the formation of a tissue lining the interior of the artery which, constantly increasing in thickness, obstructs the flow of blood through the vessel more and more, until in many cases the artery is completely closed. This morbid growth is frequently traversed by pseudo-blood-vessels, but ultimately becomes completely disorganized, usually by fatty degeneration. During the complete or partial obliteration of an artery, nature usually attempts to remedy the evil by a greater flow of blood through the adjacent smaller blood-vessels, and under the unusual pressure these frequently burst.

Dr. Stallard then exhibited a very large number of preparations showing arteries in their normal condition, as well as during the gradual progress of the disease. Some twenty fine microscopes were used for this purpose. The preparations were stained with various re-agents and were much admired for their beauty and interest. The subject was further illustrated by a large number of photographs and drawings, all well executed.

The Secretary exhibited a slide of the beautiful diatom *Arach-*

noidiscus Ehrenbergii, the frustules or which had been electro-plated with gold by Dr. A. Y. Moore of Cleveland. The slide was not only strikingly beautiful, as seen under the binocular microscope with a ½-inch objective, but the plating process was evidently of value in rendering the markings more distinct. In this particular case, the true elevation of the radial costæ was much more obvious than in the natural diatom.

AMERICAN POSTAL MICROSCOPICAL CLUB.

WE are in receipt of the mailing box "C" of the Club, which contains a handsome slide of Basalt from Schlusselberg, Bohemia. It was prepared and contributed by Prof. H. C. Lewis of Philadelphia. It was made thin by grinding with emery. It is a fine specimen and full of interest, with high and low objectives.

Slide No. 2 contains a section of the injected lung of a cat, stained just enough in haematoxylon to bring out the cellular elements in detail.

Slide No. 3 is a transverse section of the Bacura Root, that was cut in paraffine with a microtome by W. H. Walmsley, and like all slides prepared by this gentleman, they show the perfection of his work.

Slide 4 is a good exhibit of moss, and shows the confervoid filaments and gemmal both growing from the axils of the leaves. The specimen is worthy of careful study, in order to bring out the points that are interesting.

Slide No. 5, presented by Dr. G. S. Rex of Philadelphia, represents the threads or elaters of "Trichia Crysospherma," a species of the Myxomycetous Fungi or Slime Moulds. This specimen shows better than any other, the true character of the spinal threads which have been the subject of discussion among microscopists. A $\frac{1}{5}$ objective brings out the elaters plainly and shows the distinguishing features between this and the chrysospherm, viz., the striæ running parallel to the walls of the threads.

Slide No. 6 is an interesting test for the higher powers of objectives and consists of the hair of the bat.

THE Central New York Microscopical Club held a soiree November 24, at Greyhound Hall, Syracuse, N. Y. A large number of interesting objects were displayed.

EDITORIAL.

WHERE SHALL IT BE?

AT THE last meeting of the American Society of Microscopists, at Chautauqua, invitations were extended to the Society to hold its next gathering at Indianapolis, San Francisco, or Washington. As the merits and advantages of each of these places were urged by the gentlemen extending the invitations, the Society very wisely left the matter of decision with the Executive Committee, who now have it under consideration.

There are, it seems to us, several conditions which should lead them to decide upon Washington as the next meeting place. We have never met in that city, and the National Capital offers, perhaps, the greatest inducements possible of any city in this country. Not only are the great museums there, collections in which the zoölogist and comparative anatomist may revel for a life-time, but many of the scientific experts under government employ are also members of our Society, and would therefore be able to place their visitors under the most advantageous circumstances for acquiring any desired information, or inspecting the collections. Another point, and perhaps the most important, to be borne in mind is that the International Medical Congress meets at Washington early in September. By appointing the meeting of the A. S. M. toward the latter part of August, members who are physicians and who cannot absent themselves from home on two occasions would be able to attend our meeting as well as the Congress. That the government could be induced to place at the Society's disposal such rooms and apparatus as might be required for the sessions, soiree, etc., is beyond question. These are merely suggestions which might be greatly elaborated. Enough, however, has been said to indicate good reason why Washington for next year, at least, offers inducements with which no other city can compete. Let us go South for a change!

DR. THOMAS Taylor, Microscopist to the Agricultural Department at Washington, has sent some of his slides of butter and fat crystals, and a number of photo-micrographs of the same. We hope soon to report on these.

MR. R. WOODS, whose article appears in this number of THE

MICROSCOPE, has fowarded us a slide of selenite of his own mounting. The chromatic display is very fine.

PROF. A. Y. Moore has adopted the novel plan of running his turn-table by steam-power. He writes us that his engine is about "ten-fly power," and whirls the table at a very rapid rate. The entire cost of the outfit was $1.50.

THE February number of THE MICROSCOPE will contain a portrait and sketch of Prof. Wm. A. Rogers, A. M., F. R. M. S., President of the American Society of Microscopists. This number can only be furnished to subscribers, as no sample copies will be sent out.

ABSTRACTS.

BACTERIA AND DISEASE.

T. J. BURRILL, PH.D.

(CONCLUDED.)

WHEN legislators and those in authority come to intelligently understand the duties devolved upon them from this same stand point of bacteria and disease, we shall be better able as communities to baffle the invaders and spoilers. When individuals learn what to do and how to do it, the triumph must be near at hand. Families and communities must protect themselves against the injuries and diseases from poisonous foods and drinks by attention to their preparation and preservation, and by the rigid exclusion of dangerous germs. In the manufactories intelligent supervision must be demanded, in the markets faithful inspection and enforced purity rigorously insisted upon, and in the water supply especially, freedom from contamination insured.

Against the inroads of the recognized contagious diseases we have offered quarantine regulations, the isolation of the diseased, and the consumption by fire of the disease-carrying products, together with the means now known of prophylactic vaccination or inoculation and of germicidal sanitation and medication. As illustrative I will rapidly conclude with two notable examples:

Taking for our information a paper written by George Higgin, ("Nature," June 17, 1886, p. 149), compiled from the correspondence in the London *Times*, let us examine the relation of cholera

in Spain in 1885, to the water supplied to the different towns in which the disease occurred.

In Madrid, a city of 397,000 inhabitants, there was in 1865 an epidemic of cholera of a very malignant type. During the season there were sometimes from 800 to 1200 cases per day.

Last year, with a new and satisfactory system of drainage, though the proper disposal of the sewerage had not been attained, and a supply of new water of excellent quality, distributed from carefully guarded reservoirs and aqueducts, the disease never assumed epidemic proportions, but 2207 cases occurring during the whole season.

Seville, a city of 134,000 inhabitants, has, one may say, no drainage at all. One part of the town containing 30,000 inhabitants, mostly poor, is supplied by water from a river passing through Granada, a province in which cholera was epidemic in July, August and September. The main part of the town receives excellent water by covered conduits from underground springs, nine miles to the eastward. On June 14th the use of river water was prohibited for any purpose whatever and the spring only used. Although town after town along the river was attacked by the disease, Seville escaped.

Malaga, 116,000 inhabitants, in wretched sanitary condition but supplied by excellent spring water, escaped with but two or three hundred cases.

Toledo, supplied by water from the river Tagus, flowing through infected provinces, escaped entirely. The authorities stopped the pumps and obliged the inhabitants to procure water from distant springs.

Numerous other instances of a similar character are cited where, although the disease was introduced and there seemed to be every condition for its continuance, except the non-contamination of the water, no epidemic occurred. It would seem, therefore, that the facts may be taken to prove that cholera may be substantially avoided by proper attention to the water supply.

Let us, however, see the other side of the picture. Granada, with a population of 76,000, is supplied with water from aqueducts furnished from the rivers Darro and Genil. These canals are uncovered, and were exposed to contamination. Cholera broke out in July and made frightful headway. Until about the middle

of August, there were reported four hundred and fifty cases per day. The total number of cases up to the middle of September was 6,471, and the deaths, 5,093—over 6.5 per cent. of the population, against ½ per cent. in Madrid. No attempt was made to correct the water supply until the disease had become established. Sometimes hundreds of corpses were lying in the cemetery awaiting interment. The inhabitants were panic stricken and the authorities paralyzed. The course of the disease was easily followed down the river, the infected waters carrying death wherever used.

No case of cholera occurred in Valencia until the middle of May, though in the not distant territory it had been spreading during the two previous years. The water used is from the river Turia, taken from the river three and one-half miles above the town. After being passed through sand filters it is stored in a covered reservoir whence it is conducted to the city in iron pipes. The water remained in a good condition until infected in the upper portions of the river by the spread of the disease as noted, when it evidently carried the disease to the city, in which the ravages of the disease were afterward exceedingly great. By the end of June the number of cases had arisen to seven hundred daily, the total number of cases for four months 4,234.

Such illustrations may be indefinitely multiplied, all going to show the primary importance of the purity of the water supply, whether drainage and sewerage are as they should be or not. Toledo, Seville and Malaga were certainly in bad sanitary conditions, except that the water was secure from infection, and these towns conspicuously escaped any serious loss from cholera, while other towns mentioned, which were otherwise in conditions quite as favorable for health, suffered severely. Cities supplied with water from springs, and secured from contamination, were the freest from cholera. The information shows that dependence cannot be placed upon filtration of the water, as we see that at Saragossa, where charcoal filters were used, and at Valencia, where sand filters were used, the disease nevertheless raged as it presumably would have done without this attempt at protection. The only security evidently consists in obtaining waters absolutely free from infection, as at Seville, and, after the stringent governmental order, at Toledo.

Leaving this suggestive history let us attend to a wonderful

story of accomplishments in quite another direction. The one name upon peoples' lips just now, not only in our own country, but throughout the civilized world, is that of Pasteur. Indeed, in one enthusiastic paper recently written, the author says that the nineteenth should be called the century of Pasteur. His culminating work, as we all know, is that upon hydrophobia, in which it is assumed that he has obtained a method of protective vaccination against this frightful malady. It will be interesting here to pause a few moments upon a description of the man, referring to the writings of those who have recently been with him, especially Drs. Sternberg and Billings of our country, and G. M. Crawford of England.

Here he is in his office. It is a good deal of a chemist's workshop. Everything is plain and commonplace. There are shelves filled with tubes, vials, and retorts; there are tables, microscopes and apparatus; there are books and papers in unglazed cases, and the other appurtenances of a scientist's surroundings. It is an early hour in the forenoon. The man sits with his face to the window, opening letters and telegrams, sorting and arranging, filing some, throwing others into a large waste basket at his side. He is earnestly engaged in his work, heedless of the numerous eyes staring upon him through the window. As he rises we see that he is short in stature—five feet six or seven inches in height—with straight, black hair a little sprinkled with gray, short-trimmed whiskers, a large head, the bronzed complexion of a military veteran and the face of a soldier, somewhat recalling the familiar pictures of General Grant. The countenance is a grave one, indicative of earnest thought rather than of the emotional character we so frequently attribute to Frenchmen. The eyes are of a peculiar topaz-yellow and often stare directly forward as if at vacancy, lighted up now and again by flashes of inspiration and the promise of high achievement. His movements are not altogether free and easy, especially those of the limbs of one side—the result of an attack of paralysis some years since. He is not much of a talker. His conversation is direct and simple, very rarely enthusiastic; yet indications are not wanting of a fine and tender emotional quality which shows itself in his acts as well as his words. He is sixty-three years old.

The clock strikes half past ten. Pasteur rises from his seat

and going to the hall door invites the waiting candidates for inoculation to enter in file. The names are called from the ledger and the designated persons pass one by one to Dr. Grancher for the inoculation. The doctor uses a needle-pointed hypodermic syringe, which is thrust under the skin, and the contents are gradually injected. The patients are called by Pasteur in the order of their arrival, so that each receives the virus of the proper strength. The man is kind and bustling, with ready sympathy for the timid. If a little one sobs or whimpers, some trincket or coin is produced from the waistcoat pocket, which, with the accompaniment of a pat upon the head, is given the little one as an assurance of kindness; sometimes one does not have to watch very closely to see the gathering drops of sympathy in the doctor's eyes.

According to the latest statistics at command, closing April 22d, 1,335 persons have been vaccinated according to the progressive treatment adopted by the renowned investigator—thirteen from America. Each patient receives ten to fourteen inoculations on as many successive days.

In a lecture by Dr. Grancher, Pasteur's medical adviser and colleague before mentioned, the persons bitten and vaccinated were arranged in three classes:

First. Those bitten by the dog of which the spinal cord was sent to Pasteur's laboratory, inoculated in rabbits, and caused death by hydrophobia; or those who had been bitten by a dog, the bite of which had caused death by hydrophobia in other animals or man.

Second. Those bitten by a dog which before or after death had been examined and declared rabid by a veterinarian.

Third. Those bitten by a mad dog which had escaped observation.

In the first group were ninety-six patients of which one died. In the second 644 subjects and three deaths, a mortality for the two of 0.75 per cent.

It is asserted according to the best statistics that sixteen per cent. of those bitten by rabid animals die, a showing in Pasteur's treatment not to pass unheeded. The third series, though still more favorable, is not discussed because little dependence can be placed upon the reality of the disease. The mortality among patients bitten on exposed surfaces (the face and hands) was in the

first group; one in fifty-four or 1.8 per cent; in the second group three in four hundred cases, or 0,75 per cent.

M. Brouardel, in examining the statistics of the Council of Hygiene, of Paris, from 1862 to 1872, finds that in non-vaccinated persons bitten on exposed surfaces, the mortality is 80 per cent.

In addition Pasteur has vaccinated forty-eight persons bitten by mad wolves; of these seven have died, giving a mortality of fourteen per cent. Brouardel has shown that non-vaccinated individuals similarly bitten present a mortality of 66.5 per cent.

If the efficacy of the rabic vaccine be compared with that of the charbon vaccine and the Jennerian lymph, it is found that the three agents have practically the same value. Before the introduction of the Jennerian vaccination, out of one thousand small-pox patients, five hundred died, while after its introduction but twenty-three out of one thousand vaccinated persons succumbed. The value of Jennerian vaccine is, therefore, 500:23 equals 217:1.

Similarly for *charbon*. Before the use of Pasteur's vaccine the mortality was 120 per 1,000, while at present out of 1,000 vaccinated animals but five die. The value of *charbon* vaccine, is, therefore, 120: 5 equals 24:1. In rabies, before the method of vaccination, the mortality was 160 per 1,000, while after vaccination the deaths were seven per 1,000. The value of antirabic vaccine is, therefore, 160 : 7 equals 22.85 : 1. That is, those various vaccinations saved about twenty-two out of twenty-three patients, who would otherwise hopelessly die of the specified diseases. Of course it will be remembered that prophylactic vaccination against small-pox prevents a far greater percentage of cases of disease.

The antirabic vaccination by Pasteur has been very differently commented upon. He has been denounced as an enthusiastic fanatic and extolled as the most eminent and beneficient genius of the country. When, however, we carefully examine the records of facts and assure ourselves of the painstaking fidelity with which they are compiled, when we ascertain to our satisfaction the sincere and honest character of the renowned investigator, we cannot help but ascribe to him the profound gratitude of our hearts. When we remember the frightful character of hydrophobia as a disease, the hopelessness of treatment, the utter paralysis of medical skill in the presence of the unknown agent of the affliction, and of the agonies of the sufferer, we cannot avoid, we would not avoid join-

ing with hearty voices in the ringing plaudits of praise to the man who has robbed the disease of its terror, and who daily gives hope and joy to those who were otherwise doomed to die most miserably, or to suffer even worse tortures of mental distress and gloomy forebodings.

Pasteur has been most unjustly charged with keeping his method secret. Nothing can be further from the truth. He has fully published his processes, and has generously given instruction to several qualified surgeons, and maganimously furnished them with his prepared materials. In gratitude for his achievements, the City of Paris has given him land, and donations are rapidly accumulating from all quarters for a large international hospital for his use, named the "Institution Pasteur." Pasteur hospitals are also in process of founding in Italy, Austria, Prussia and America, each having already received the modified virus and methods of operation from Pasteur himself.

THE MICROSCOPE IN PHARMACY.—It is undeniable that the microscope will be one of the important instruments of the drug store of the future. As already refered to, drugs now come into the market in such altered conditions that the naked eye cannot recognize them. This gives great opportunities for adulteration, and microscopy is the most convenient path out of the difficulty. The instrument will grow more and more popular each year, as the profession becomes better educated and the public learns the importance of guarding against inferior or adulterated drugs. Even at the present time the importance to the pharmacist of the study of microscopy is quite generally recognized. The leading colleges of pharmacy have laboratories equipped with facilities for giving the students instruction in thi shighly interesting and valuable study.—*H. M. Whelpley in Nat. Druggist.*

EQUINE RELAPSING FEVER.—Another illustration of the importance and practical use of the microscope in all departments of the healing art, is to be found in the report of J. H. Steele, A. V. D., veterinary surgeon. During the years 1883 and 1884, the transport mules in British Burmah became affected with a fatal disease, which in two stations, Rangoon and Tounghoo, carried off one-hundred and eighty-two animals, which represented a loss of 30,000 rupees. This affected the means of transport to such a degree,

that Mr. Steele was specially deputized to investigate and treat the disease. Mr. Steele, says the *Philadelphia Medical News*, set to work with thermometer and microscope, and showed that the disease was a true relapsing fever, probably resembling closely, although not absolutely identical with, the relapsing fever of man. Experiments proved the communicability of the disease by ingestion and inoculation to the dog, horse, mule and monkey, and examination of the blood by the microscope revealed the existence of a parasite of the nature of a spirillum, very similar to the form found in the relapsing fever of man, and, like it, alternately disappearing during the relapses and intervals of the fever.

DEVELOPMENT OF FLEAS. Mr. George Harkus has succeeded in obtaining the whole process of the development of the flea from the laying of the egg up. He undertook to begin his experiments with two egg-laden females in a box, but the only result was a fierce battle that compelled separation of the two at once. Each individual laid a batch of from three to twenty-four eggs—the average was about a dozen—white and oval. Each end of the oval appeared through the glass surrounded by a spiral whorl of oval punctures, eighty at one end and and forty at the other. The eggs were so nearly transparent that the whole process of development could be easily watched, and the exhibition, to judge from the warm terms in which it is described, must have been extremely interesting. The larvæ resembled elongated little worms, were destitute of feet, and kept up the usual wiggling motion of their kind. They absolutely refused to be fed, and usually died in a few days, so that very few crysalides were obtained.

Perhaps if they had been given their natural way of feeding, whatever that may be, the success might have been better. Any exposure to cold or damp was immediately fatal. The larvæ, as the pupa stage was approached, assume a red hue, and, about eight days from hatching, spin a cocoon like a fluffy speck of white cotton. The threads are closely woven and of extreme tenuity, and, when attached to a textile material of similar color, must be very difficult of detection.

A cocoon was opened after the inmate had divested itself of the pupa-case, but still remained enveloped in a filmy transparent integument. This pellicle covered the insect completely, following each leg and antenna continuously. "About four weeks is re-

quired to metamorphose the speck of vitalized matter contained in the minute ovum of *Pulex Irritans* into a suctorial tormentor."—*Popular Science Monthly.*

PARIETAL EYE OF HATTERIA—Mr. W. Baldwin Spencer reports in *Nature*, a remarkable discovery—the presence of a median parietal, or, as it might more justly be called, interparietal eye in *Hatteria punctata*, the curious lizard of New Zeland. The epiphysis cerebri of amphibians and reptiles becomes divided into two parts, the proximal of which remains connected with the brain, while the distal is a bladder-shaped structure. In *Anguis fragilis* this distal as Von Graaf finds, loses all connection with the brain, and develops into a structure resembling a highly organized invertebrate eye; no nerve, however, is connected with it. In *Hatteria* the similar eye-like organ is provided with a well marked nerve. The eye is enclosed in a capsule of connective tissue; anteriorly there is a lense which forms the anterior boundary of a vesicle, the walls of which are formed from within outwards of the following layers: 1st. Not a well-marked layer. 2d. A large layer of rods embedded in dark-brown pigment. 3rd. A double or triple row of nuclei. 4th. A clear layer which may be called the molecular, and 5th a layer of nuclei two or three rows deep. The nerve which enters the eye posteriorly spreads its fibres round the vesicle. A blood-vessel ramifies in the surrounding connective tissue. The eye lies exactly in the median line, and the nerve is single; the latter appearing to represent the stalk connecting the distal with the proximal outgrowth from the thalamencephalon. The eye does not reach the surface, but is imbedded in the connective tissue, so deeply, indeed, as almost to preclude the idea of its being affected by light. In a postscript Mr. Spencer adds that he has since found the eye in *Ignana*, *Chameleo vulgaris*, and *Lacertaocellata* and has traced the nerve into the proximal part of the epiphysis —*Royal Mic. Jourl.*

LEECHES OF JAPAN.—A recent account of the leeches of Japan, by Dr. C. O. Whitman, is illustrated by colored drawings by Mr. Nomura, a young Japanese artist. That the Japanese can make excellent zoological artists is shown by Dr. Whitman's remark: "Mr. Nomura's attention to the minutest details, his infinite patience, trained eye and his remarkably skillful brush, have given results that are marvels of neatness and accuracy." The Japanese land

leech is among others the most interesting from its habits. It is confined to the mountain slopes and ravines, never descending into the plains. It is not only a mountain leech, but it keeps habitually to the ground, living in moss or under damp leaves and rubbish. They are most voracious, and on the approach of man or beast are at once on the alert. They advance by rapid strides. They bite so gently as scarcely to attract attention; but the wound is deep, and the scar is more or less permanent. They gorge themselves for about thirty to forty minutes, and then drop; while sucking they become bedewed with a transparent liquid, which keeps them moist. If placed in water they do not swim, but sink, and then creep out, and while having a decided preference for a terrestrial life, can support life for days in water. If into a jar of hungry leeches a puff of breath is blown, they become much excited, and it will be difficult to keep them in; while trying to keep back one, a dozen others will get out. The geographical area of land leeches is mainly within the tropics, though in Japan they are exposed to a wide range of temperature. A new medicinal leech was discovered, well known to the Japanese, and with habits just like the European leech. In these leeches, the segmental organs are shown to be sense-organs, and the author believes that from them the eyes have developed, so that he regards them as incipient eye-spots.

ANCIENT EGYPTIAN PLANTS.—"The recent exploration of unopened tombs belonging to an early period in the history of the Egyptian people has permitted the examination of the plants in a condition which could not have been anticipated. And happily, the examination of the materials has been made by a botanist who is thoroughly acquainted with the existing flora of Egypt, for Dr. Schweinfurth has for a quarter of a century been exploring the plants of the Nile valley. The plant-remains were included within mummy wrappings, and, being thus heremetrically sealed, have been preserved with scarcely any change. By placing the plants in warm water, Dr. S. has succeeded in preparing a series of specimens gathered 4000 years ago, which are as satisfactory for the purpose of science as any collected at the present day. These specimens consequently supply means for the closest examination and comparison with their living representatives. The colors of the flowers are still present, even the most evanescent, such as the violet of the larkspur and knaporeed, and the scarlet of the poppy. The

chlorophyll remains in the leaves, and the sugar in the pulp of the raisins. Dr. Schweinfurth has determined no less than 59 species, some of which are represented by the fruits employed as offerings to the dead, others by flowers and leaves made into garlands, and the remainder by branches on which the body was placed, and which were enclosed within the wrappings."—*President's Address Section Biology, British Association.*

TO DISTINGUISH OLEOMARGARINE FROM BUTTER.—J. Horstler recommends the following procedure: A piece of oleomargarine, the size of a hazelnut, is placed in a test-tube, and the end made air-tight. Into another test-tnbe a like quantity of butter is treated in the same way. When both test-tubes are held in the hand the oleomargarine soon liquefies, forming a clear solution; whilst butter requires double the time for solution, and when dissolved is not so clear as the oleomargarine solution. When the tube is filled one-third with ether, the oleomargarine is easily dissolved, and does not produce any turbidity or precipitate on the addition of alcohol. Butter when treated in like manner yields a precipitate.

GOLD CRYSTALS.—Although crystals of gold occur in Nature, they have never been produced artificially. By allowing a solution of the double chloride of gold and sodium to stand, Mr. W. N. Allen has observed that perfect little regular three and six sided tablets of metallic gold are slowly deposited. The crystals were about 0.003 of an inch in diameter, and the upper surface shows a strong reflection.

WORKING WITH THE CAMERA LUCIDA.—Playfair gives this advice in the *English Mechanic* in regard to the camera lucida: 1. In working with a camera lucida, one of the best plans is to use two lights, one to illuminate the object, and the other the paper. A candle does perfectly as the second source of light.

NEWS AND NOTES.

TWO new botanical journals have appeared in Italy, *De Notaris* and *Malpighi.*

IT IS stated that Carl Zeiss of Jena, recently placed in a box, with his own hands, the ten thousandth microscope he has made.

IT IS CONCEDED, says the *San Francisco Call*, that the Lick telescope, when completed and mounted in the Observatory prepared

for it at Mount Hamilton, will be the largest instrument of the kind in the world. It is understood that the lenses have been successfully cast, and only need polishing to be ready for use. In looking through this telescope it is reckoned that the moon will be brought within thirty miles of the earth, and that discoveries will be made on that planet to solve problems that have heretofore been held to be unsolvable.

AN amusing brochure reviewing the work of M. Pasteur has recently appeared in France. It is entitled "Microbe-culture, or the Art of becoming a Millionaire by means of a Scientific Hoax." The author is Dr. Marron.

AT the last meeting of the Southern Dental Association, Dr. E. S. Chisholm read a paper on the importance of the occular demonstrations the microscope affords of the histological conditions of tooth structure as an element in determining the pathological conditions in the etiology of the decay of the human teeth.—*Arch of Dentistry.*

ACCORDING to Prof. Vogel, plants do not always contain their characteristic alkaloids when grown under other than natural conditions. Hemlock does not yield coniine in Scotland, and cinchona plants are nearly free from quinine when grown in hot-houses. Tannin is found in the greatest quantity in trees which have had a full supply of direct sunlight.—*Med. News.*

DR. F. L. JAMES is giving a valuable post-graduate course in microscopical technology in his *St. Louis Medical and Surgical Journal.* The instruction given is more practical and useful than that to be found in any text book, and is the outcome of a long and successful experience with the microscope. We hope to see these articles republished in a more convenient form later on.

WRITERS in the *English Mechanic* have been at loggerheads over the relative merits and costs of English and foreign microscopes. A few individuals condemn everything un-English—but the majority agree, that the best foreign makes are fully up to the English standard. The time has come when Americans need no longer go abroad for their stands and lenses—for no better or more accurate work is turned out anywhere than by our own manufacturers.

BOOK REVIEWS.

THE PHYSICIAN'S LEISURE LIBRARY: Detroit, Geo. S. Davis. This is a series of short, practical treatises by eminent writers of this country and Europe, upon subjects of interest to the general practitioner. The series will be complete in twelve numbers, published monthly. Six have been received, viz: Inhalers, Inhalations and Inhalants, by Beverly Robinson, M. D.; The Use of Electricity in the Removal of Superfluous Hair, and in the Treatment of Various Facial Blemishes, by Geo. H. Fox, M. D.; New Medications, by Dujardin Beaumetz, M. D; The Modern Treatment of Ear Diseases, by Samuel Sexton, M. D.; Spinal Irritation, by Wm. A. Hammond, M. D.; The Modern Treatment of Eczema, by Henry G. Piffard, M. D. and Antiseptic Midwifery, by Henry J. Garrigues, M. D. This is a new departure in medical publications. It enables the physician to obtain at a nominal cost the latest ideas upon treatment without being compelled to purchase costly text books filled with matter which he already possesses. The numbers are handsomely bound in paper and can be bought in series or singly.

OUR London Agent, Mr. W. P. Collins, has sent us his latest catalogue and list of books, new and second hand, on microscopy and allied sciences. These lists are published monthly, and are an important addition to the working-library,—keeping the microscopist informed of all the latest works published in England and on the Continent,—and the prices for which they may be obtained. Mr. Collins' catalogue also contains a list of many old and rare books. Sent on application.

MICROSCOPICAL DIAGNOSIS, by Chas. H. Stowell, M. D., and Louisa Reed Stowell, M. S. Geo. S. Davis, Publisher, Detroit. From the time of first issue, some four years ago, to the present, this little work has held good favor among those interested in microscopy. It is particularly well adapted to the beginner and amateur, as much attention is given to elementary detail. In this lies the principal value of the book, and makes it fit well the present stage of microscopical science in this country. The work is divided into three parts. The first part treats of the microscope, and a general view of animal histology, including a chapter on urinary deposits—with really admirable plates—some leading points on tumors, parasites, etc. The second is devoted to vegetable struc-

tures. The article on wheat is very exhaustive and gives one a good idea of certain plant formations. The third comprises a series of articles written originally for "THE MICROSCOPE" by W. H. Walmsley. The name of the author is a sufficient guarantee of their excellence. Altogether the work is worthy the perusal of all workers—especially beginners—in microscopy.

MICROSCOPICAL RECORDS.—Chas. E. Alling, Rochester, N. Y. Since receiving the advanced pages of the "Microscopical Records," as published by Chas. E. Alling of Rochester, N. Y., we are in receipt of a copy which far exceeds our anticipations. It is handsomely bound in cloth with leather back and corners and contains spaces for one thousand specimens. There are twenty pages for formulæ, after which follows an alphabetical index. The paper and press work are very creditable, and we heartily endorse the work, for it seems to supply a need among microscopists which has long been felt, and we believe that the book has but to be seen to be appreciated.

PUBLISHER'S ANNOUNCEMENT.

READERS of THE MICROSCOPE will note the circumstance that its publication has passed into new hands. The arrangement under which it has been published since its recent change of ownership was only a temporary one. Hereafter the business management of the journal will be wholly distinct from its editorial conduct. The former we have assumed, regarding it as a business enterprise capable of being developed and rendered remunerative. The latter will remain in the hands of a body of men whose scholarly and professional attainments we feel sure will secure for THE MICROSCOPE a largely increased subscription list.

We propose on our part to exert ourselves to render THE MICROSCOPE hereafter as attractive in its external appearance as it is intrinsically valuable in its contents, and to make its advertising columns profitable both to readers and to those who shall favor us with advertising patronage.

Hereafter all communications relating to subscriptions or to advertisements should be addressed to D. O. Haynes & Company, P. O. Box 583, while communications or publications and editorial correspondence should be addressed to "THE MICROSCOPE," 83 Lafayette Avenue, Detroit, Michigan.

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(Exchanges are inserted without charge. Subscribers having microscope apparatus for sale or exchange can announce the same without charge.) Subscribers will confer a favor by notifying us an "exchange" has served its purpose, in order that others may find room.

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FOR EXCHANGE.—Living specimens of *Volvox Globator* by mail for other "raw material" or mounted slides. Also one of Queen's dollar sets of untreated diatoms. Polycystines especially desired
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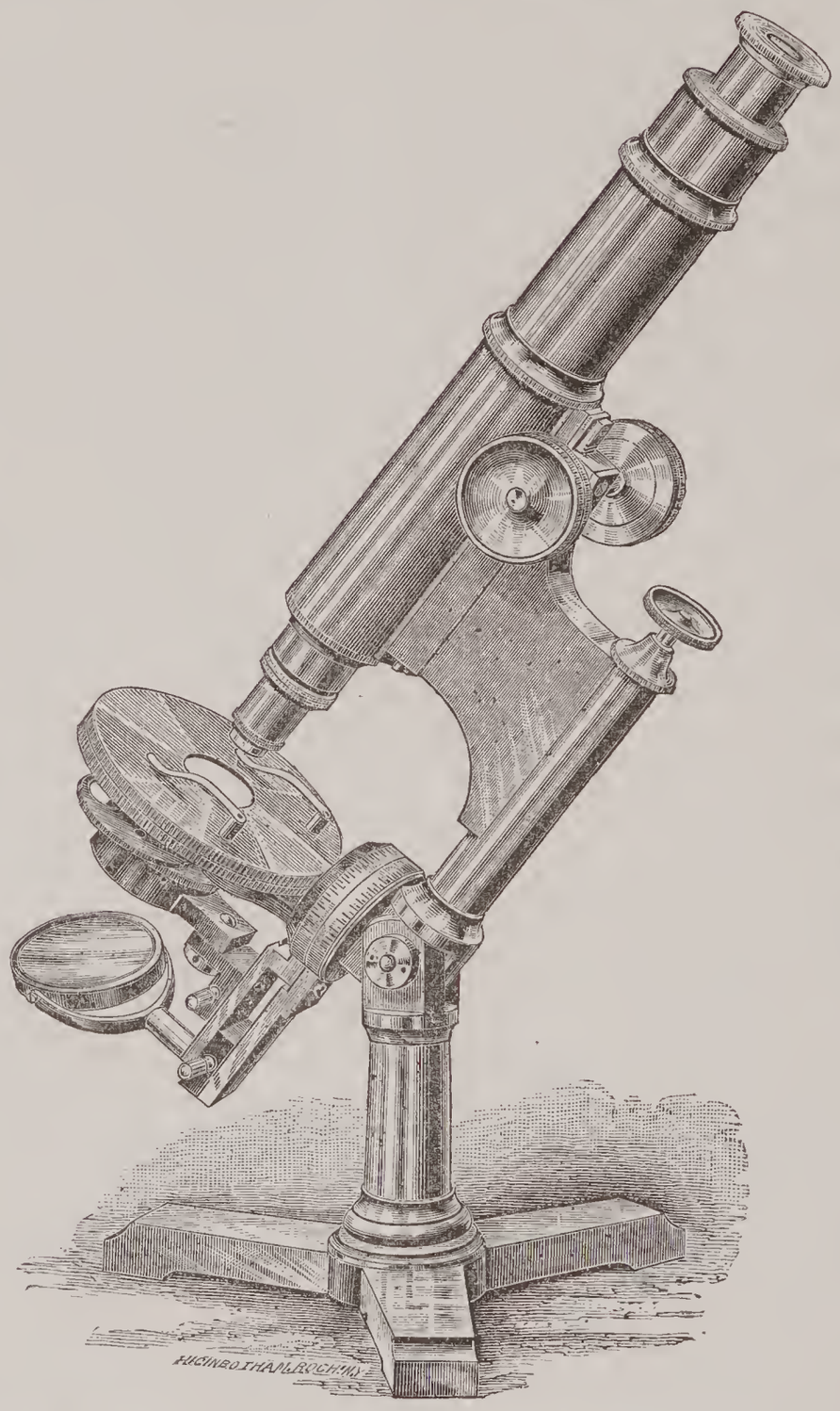

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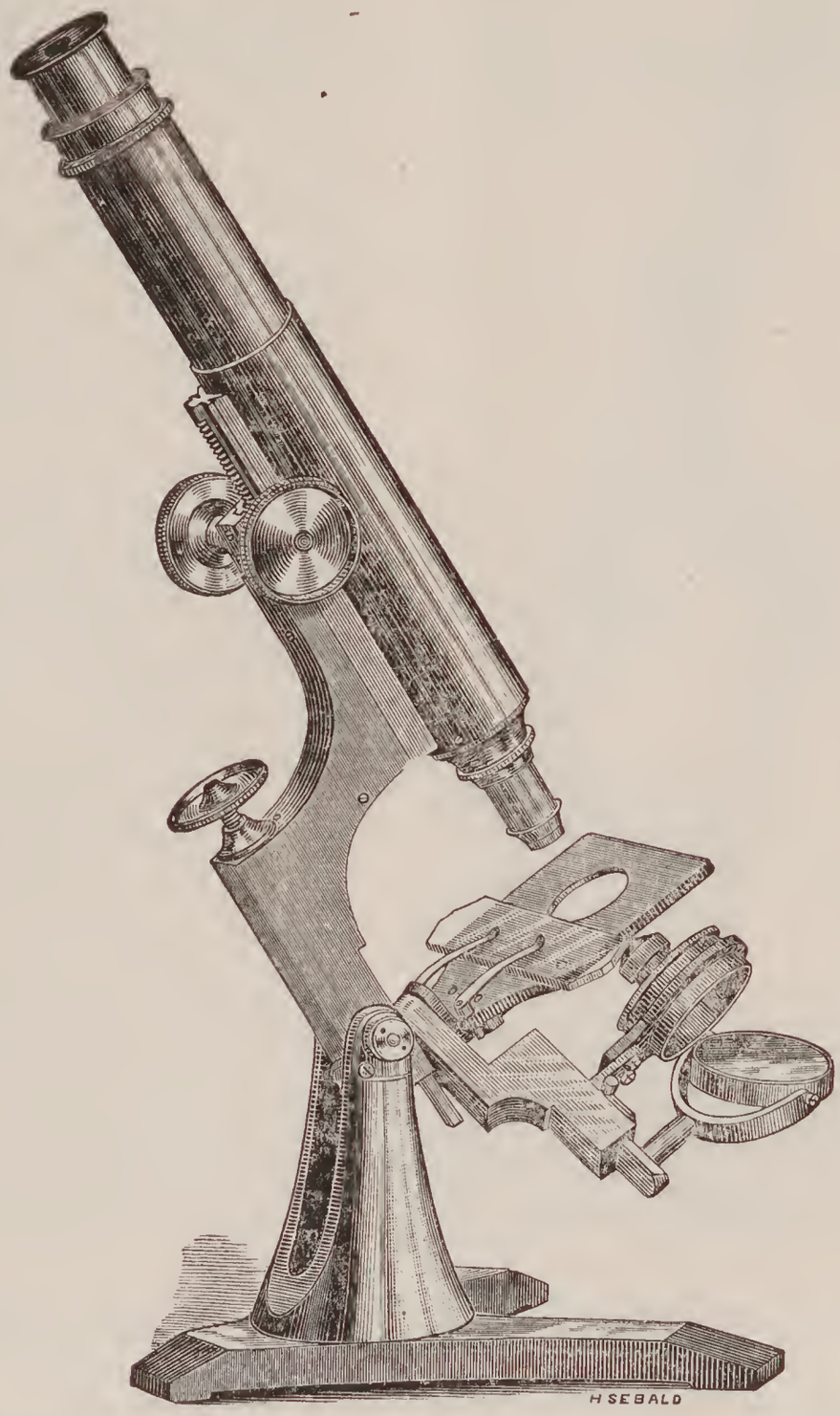

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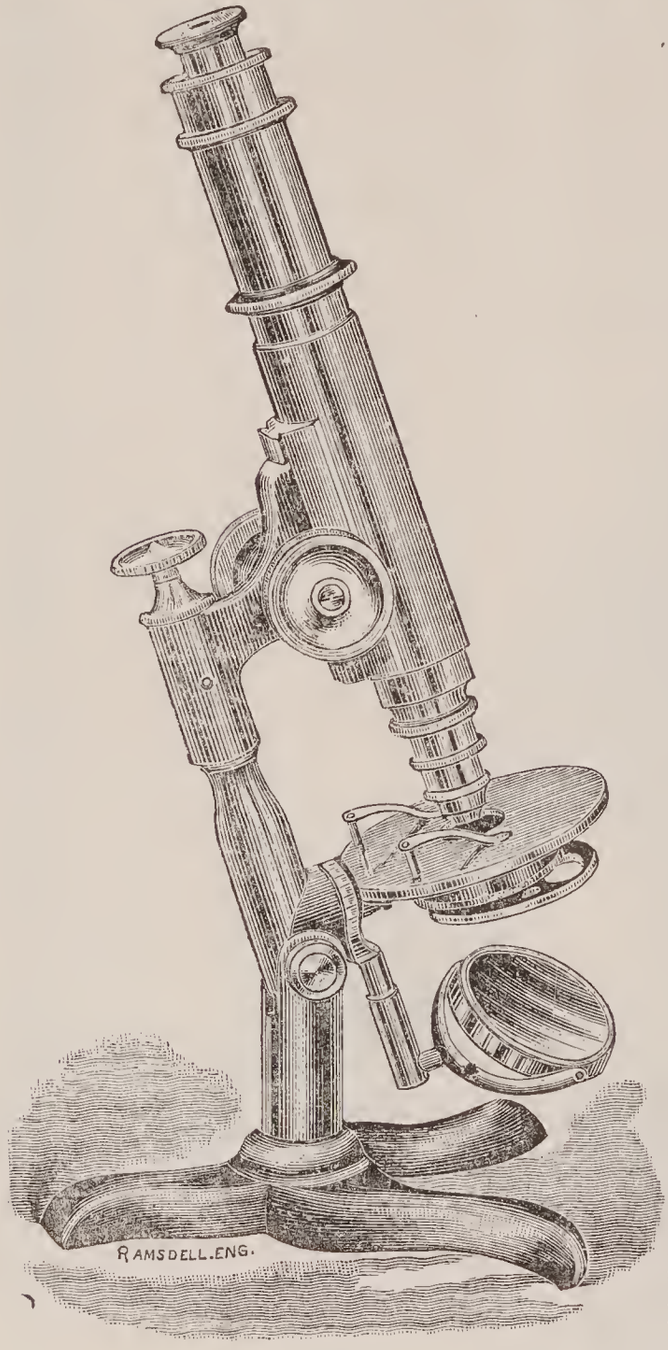

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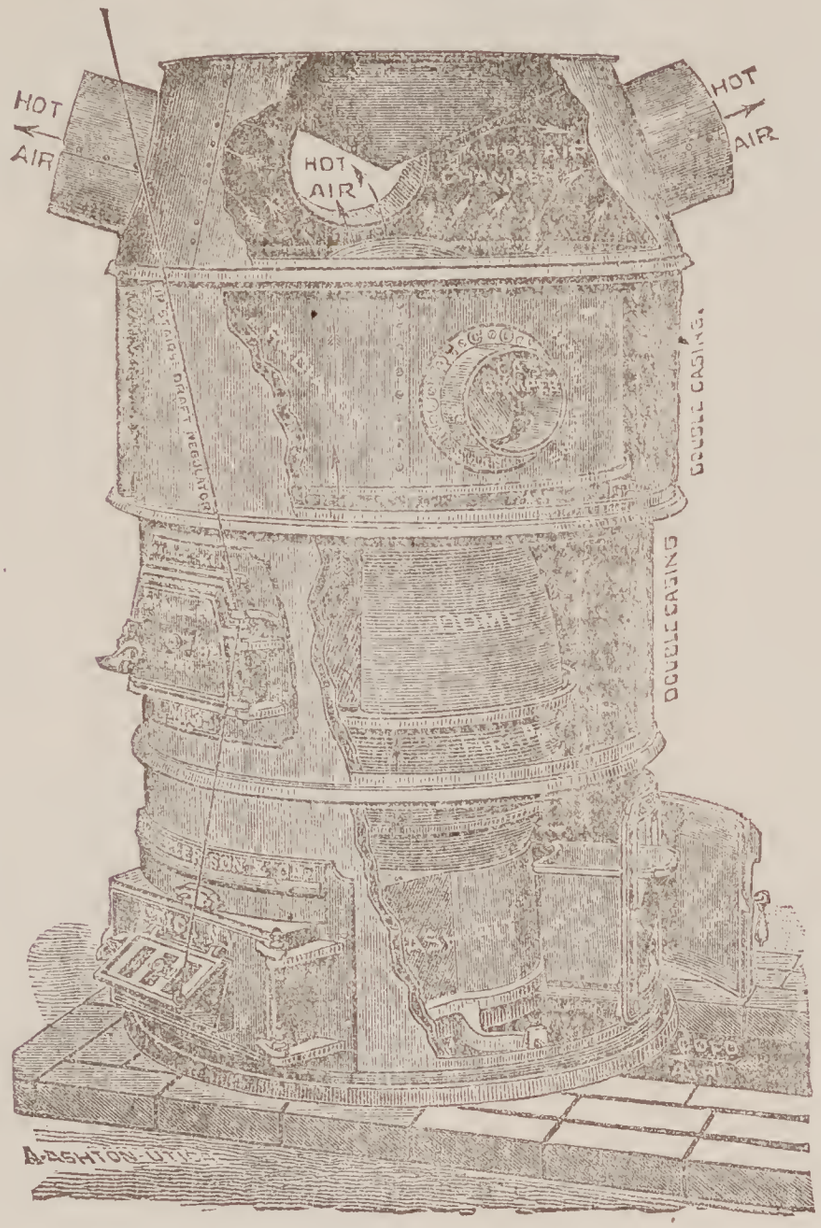

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CHAS. H. STOWELL, M. D., F. R. M. S., Professor of Microscopy and Histology, Univ. Mich.

LOUISA REED STOWELL, M. S., F. R. M. S., Assistant in Microscopical Botany, Univ. Mich.

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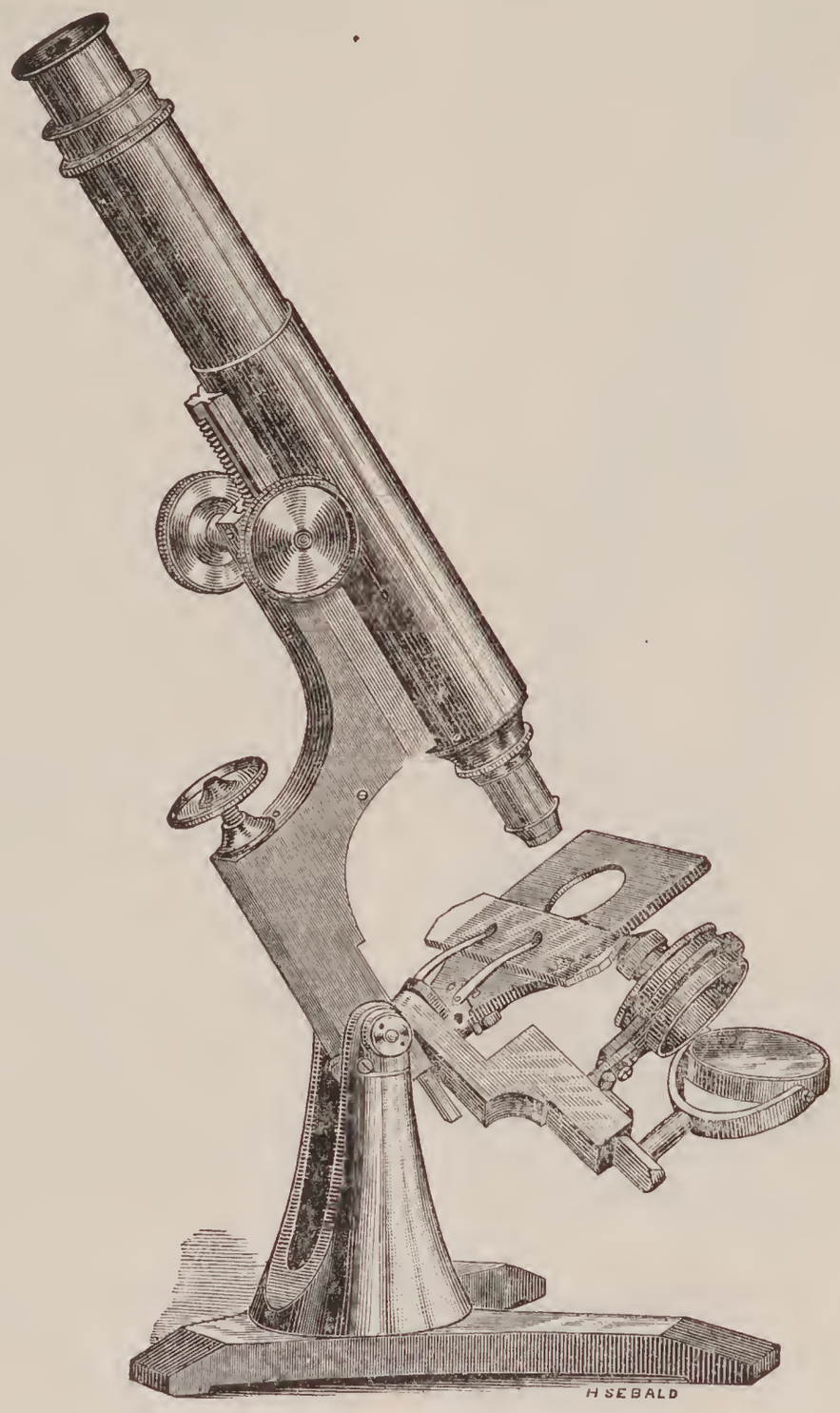

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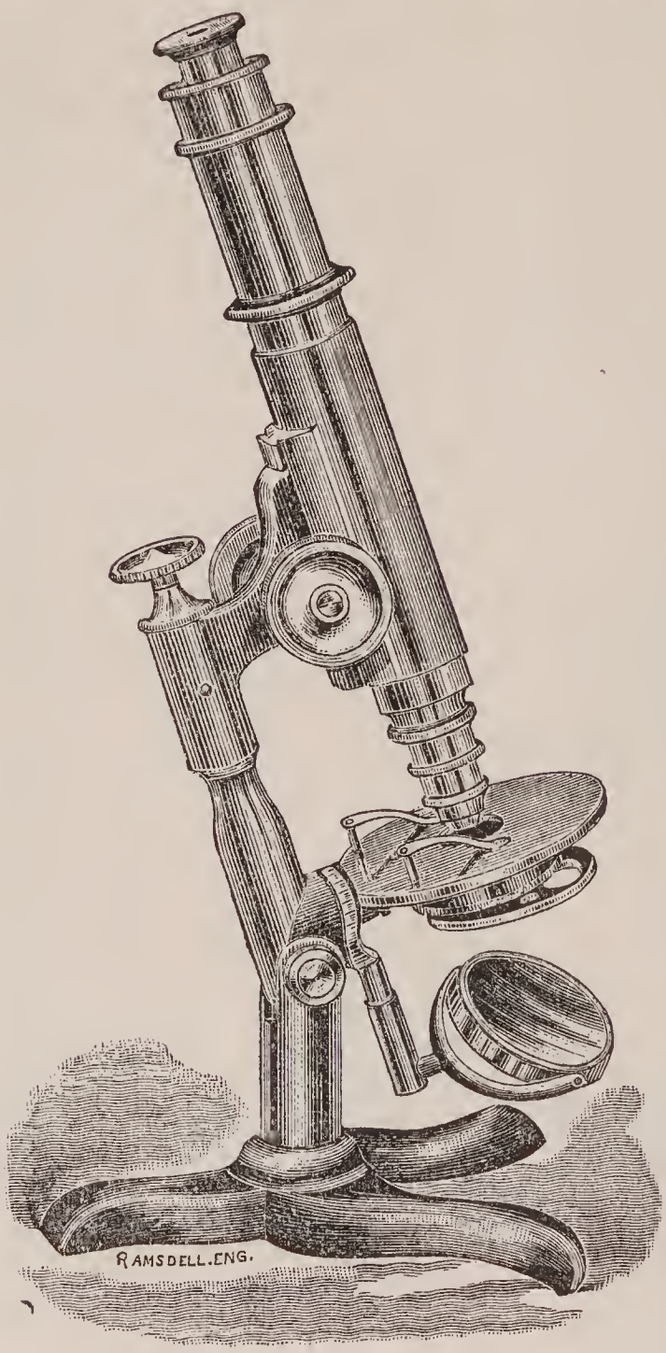

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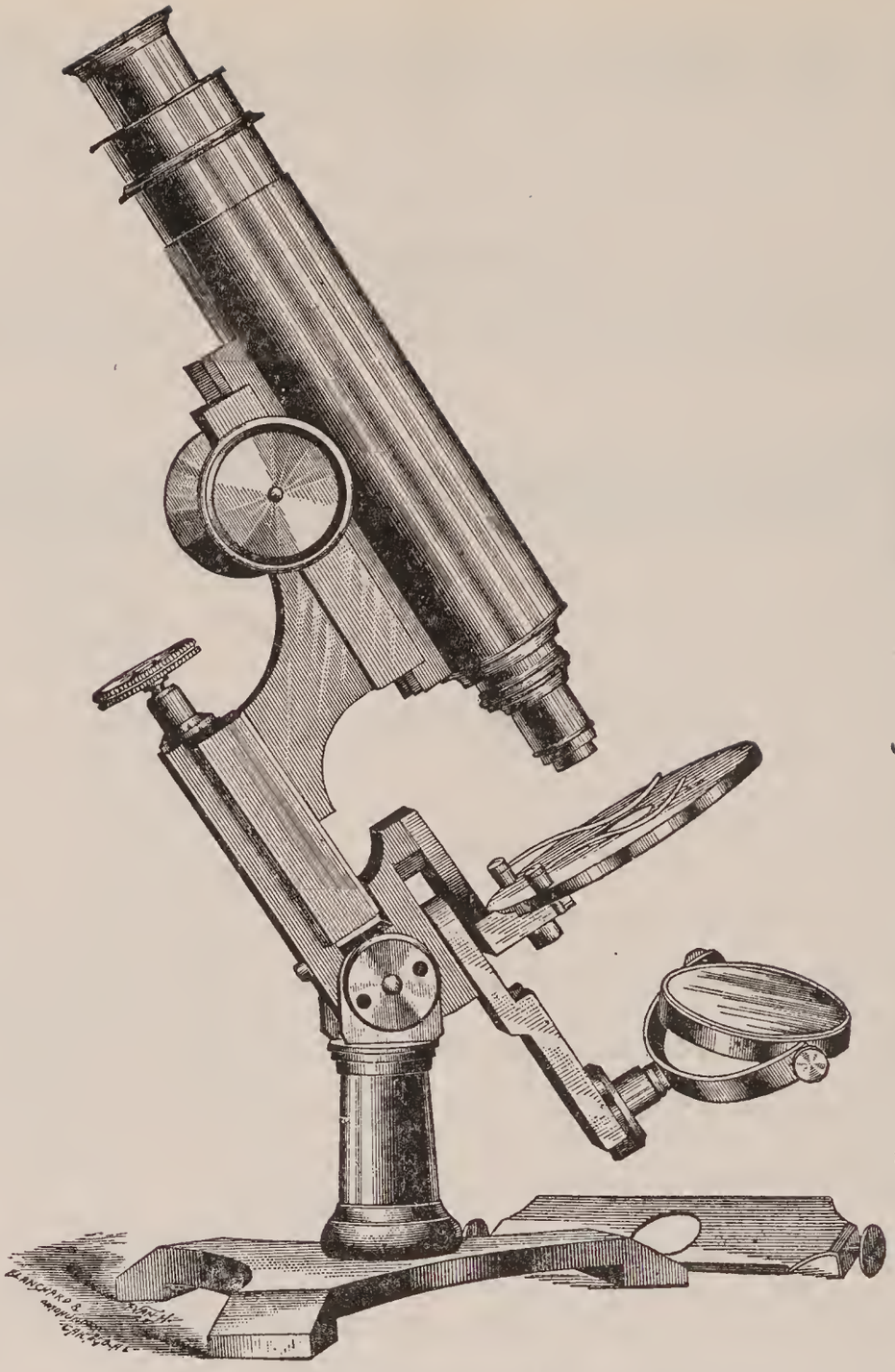

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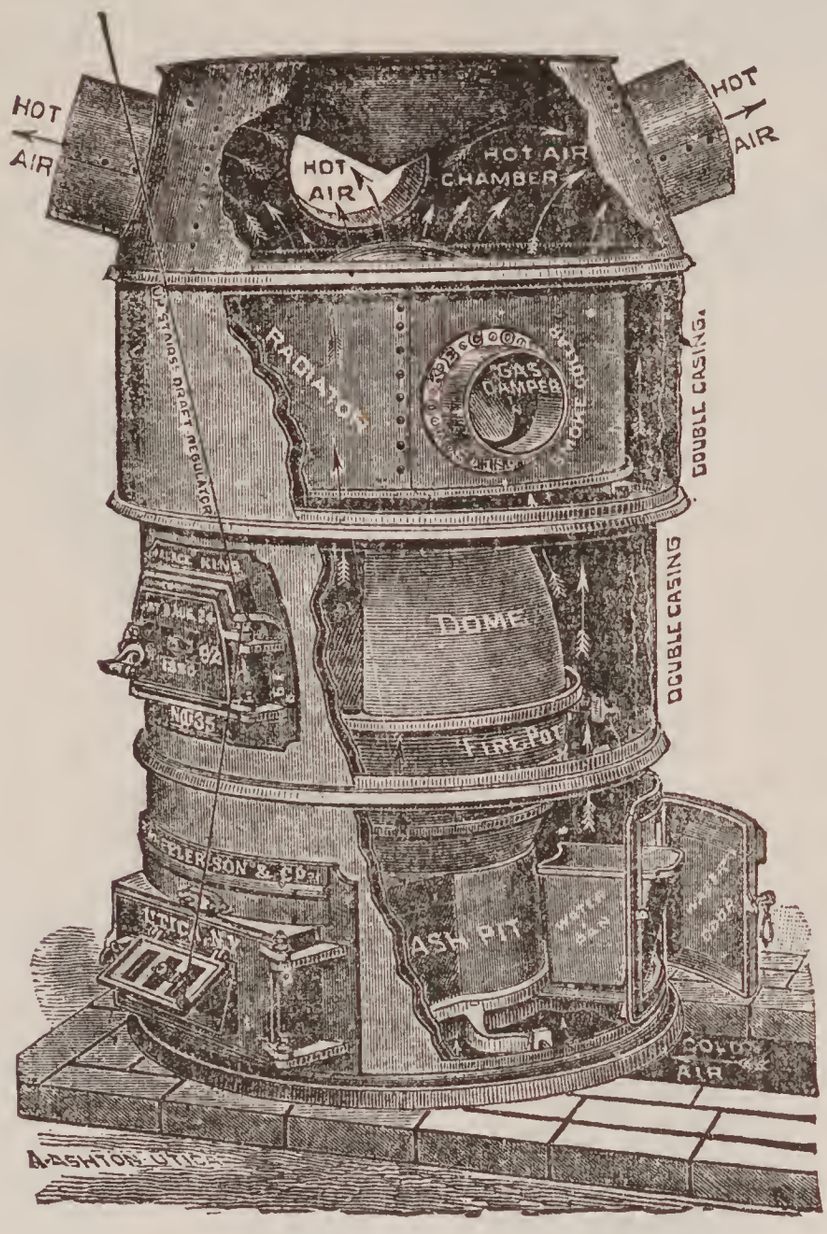

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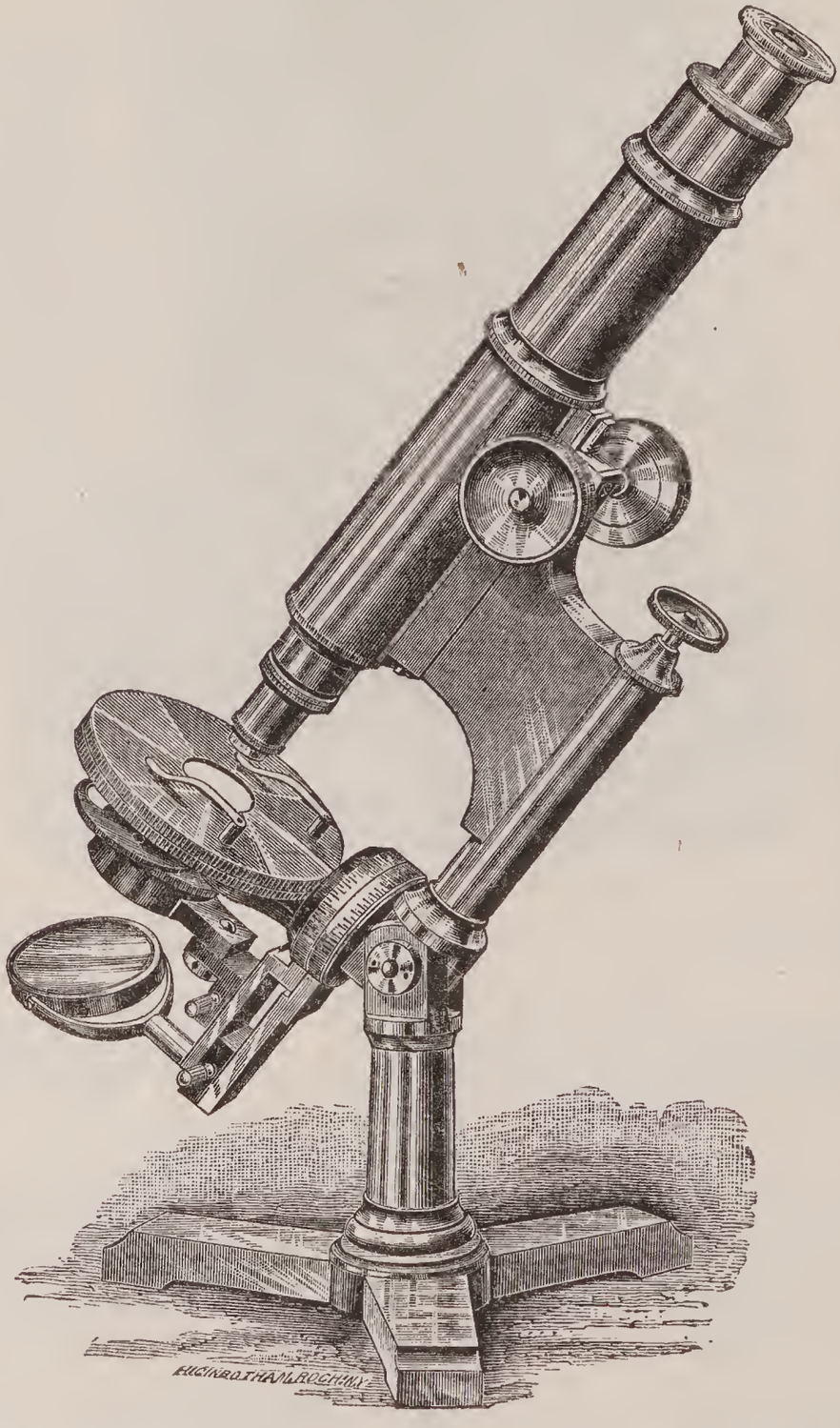

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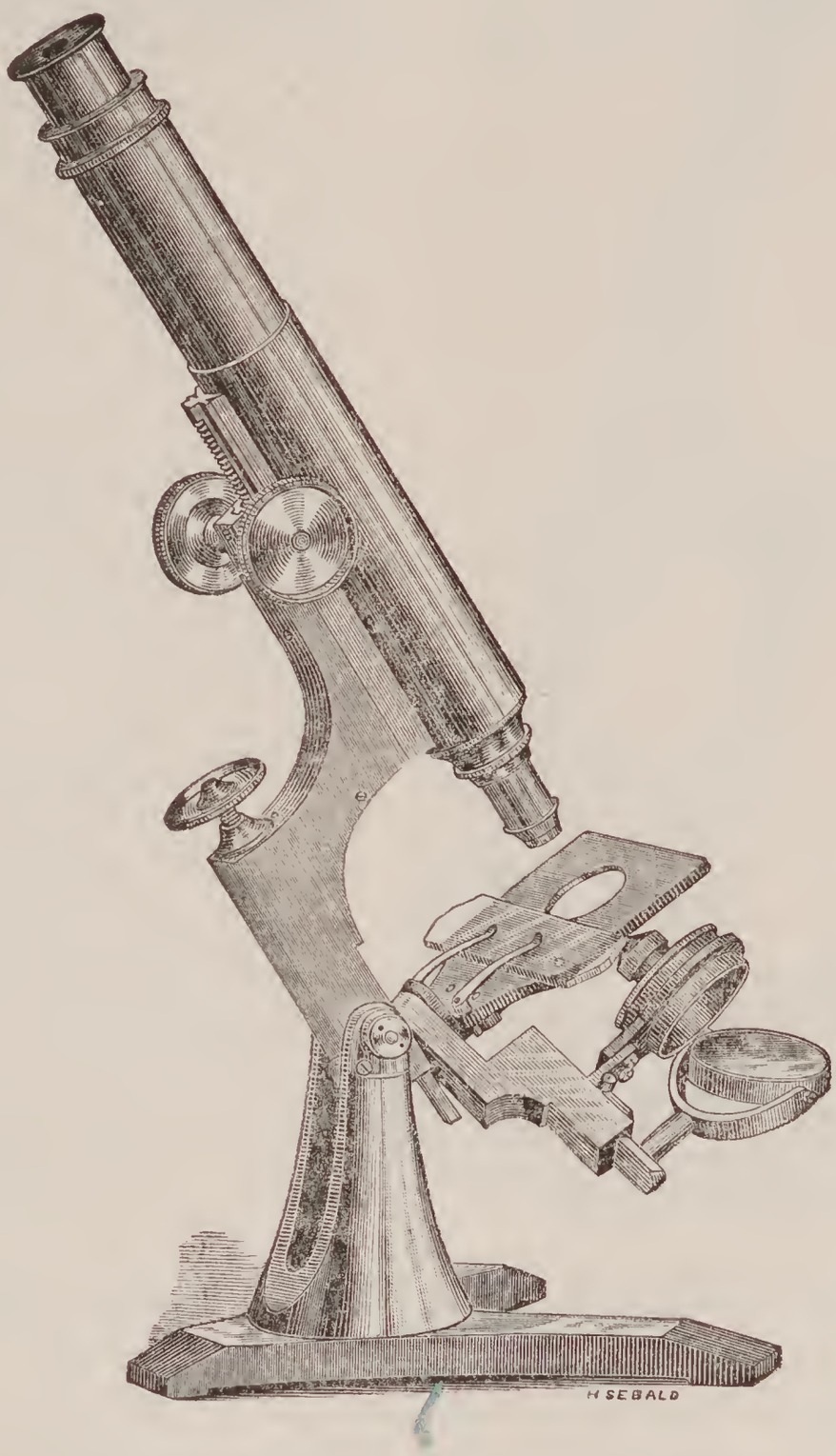

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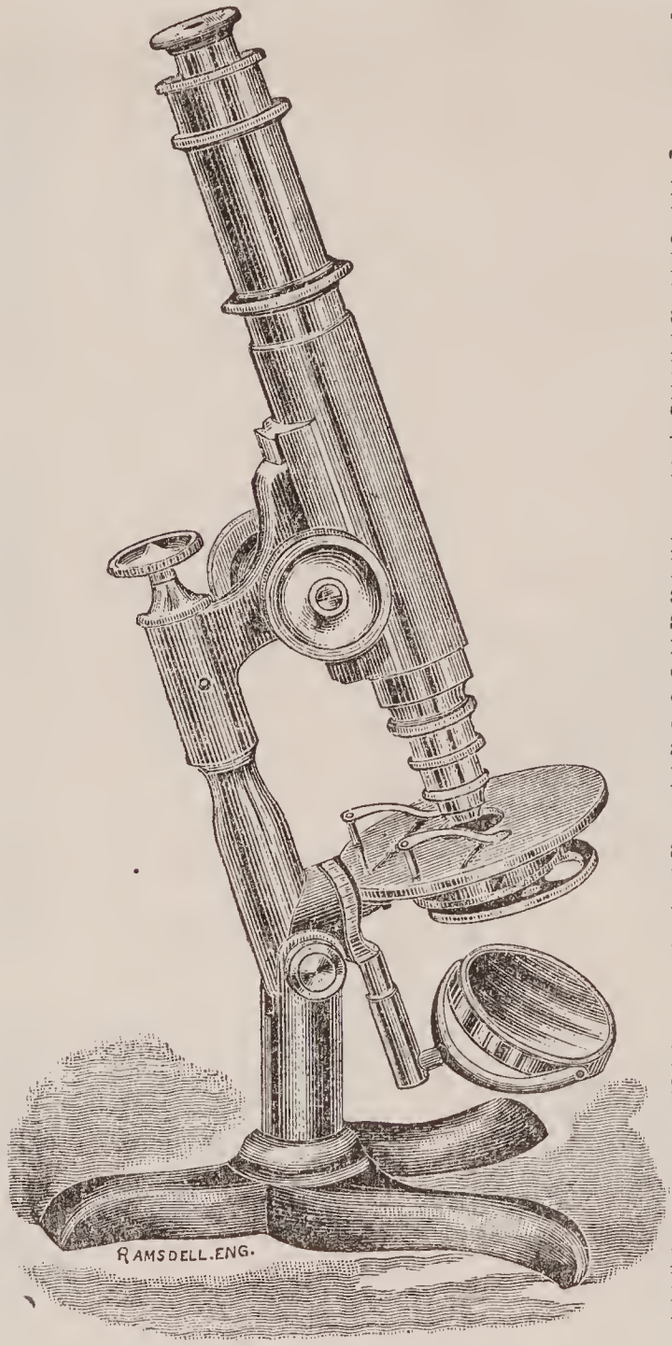

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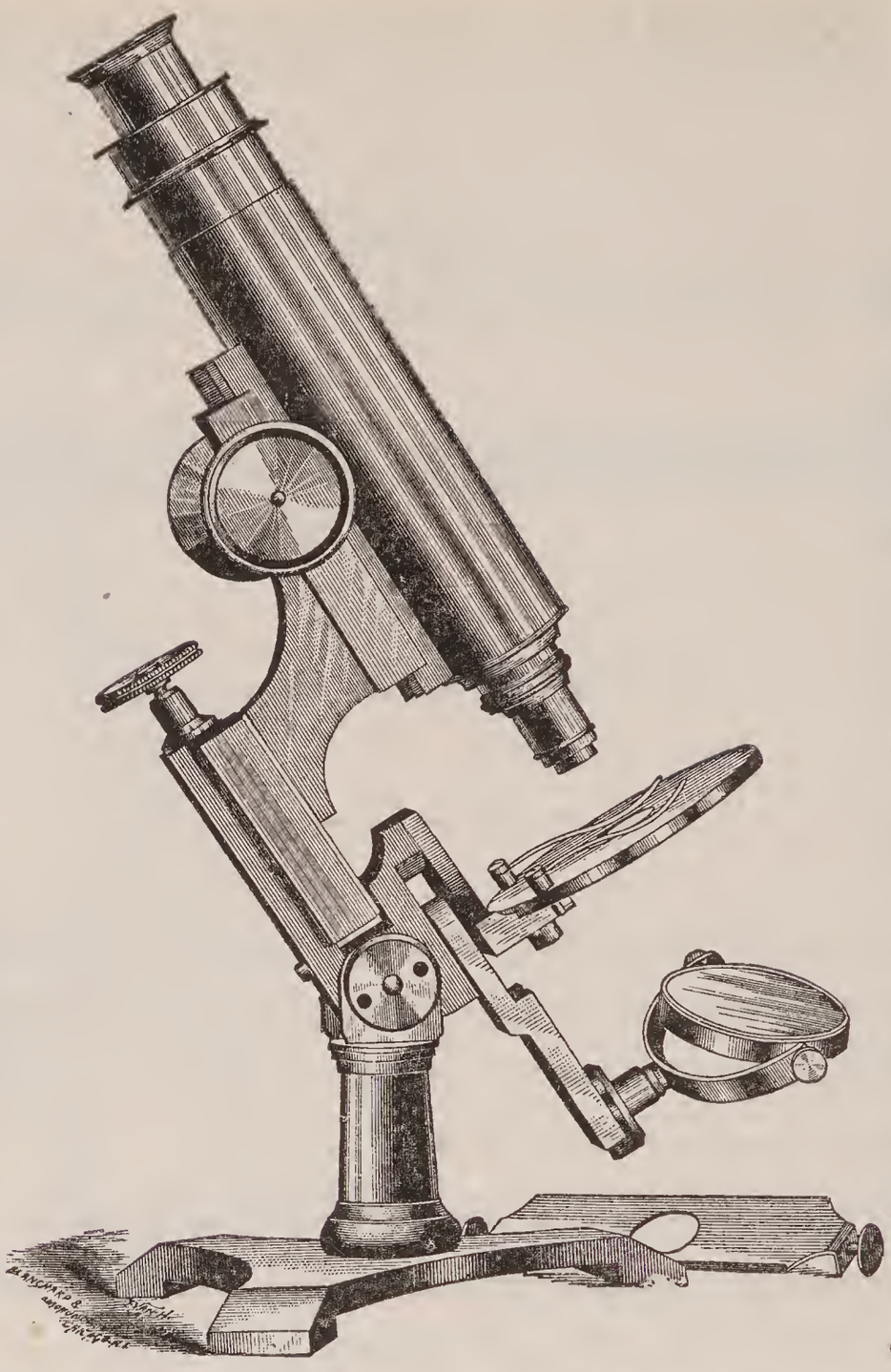

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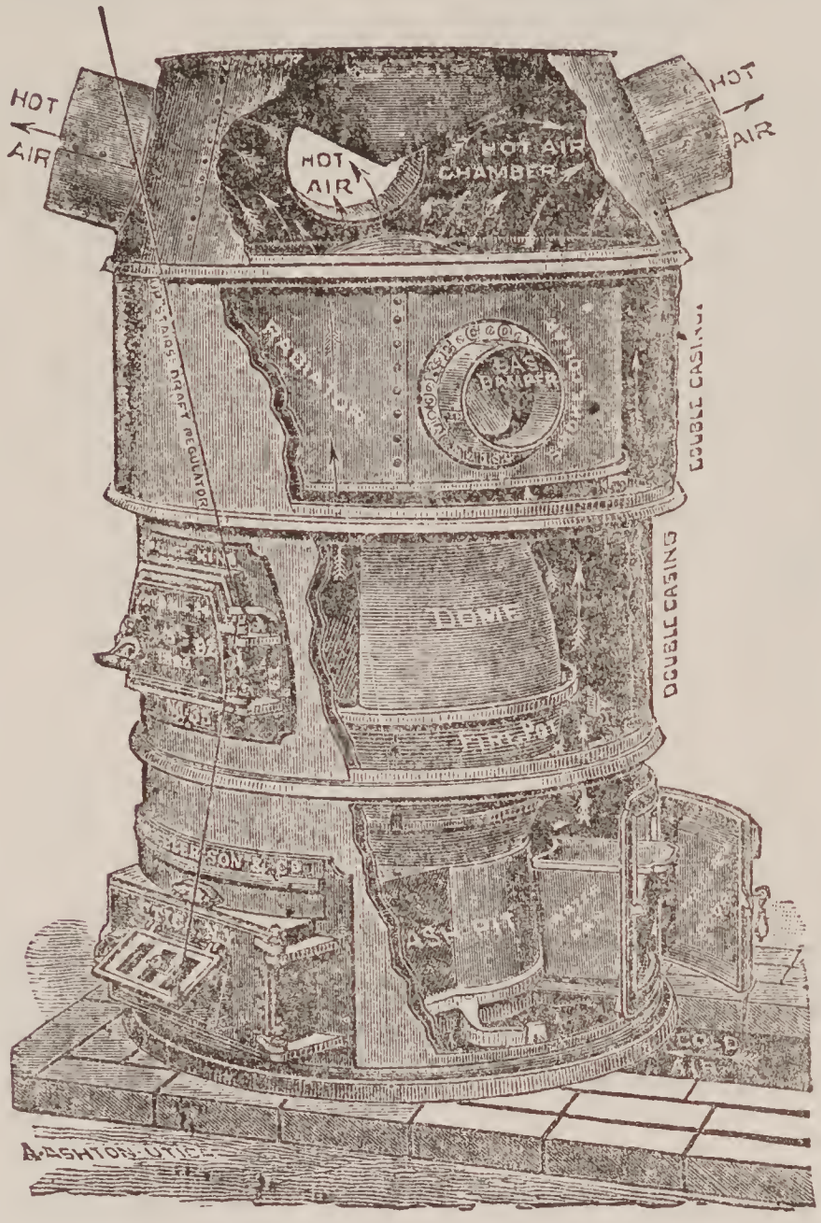

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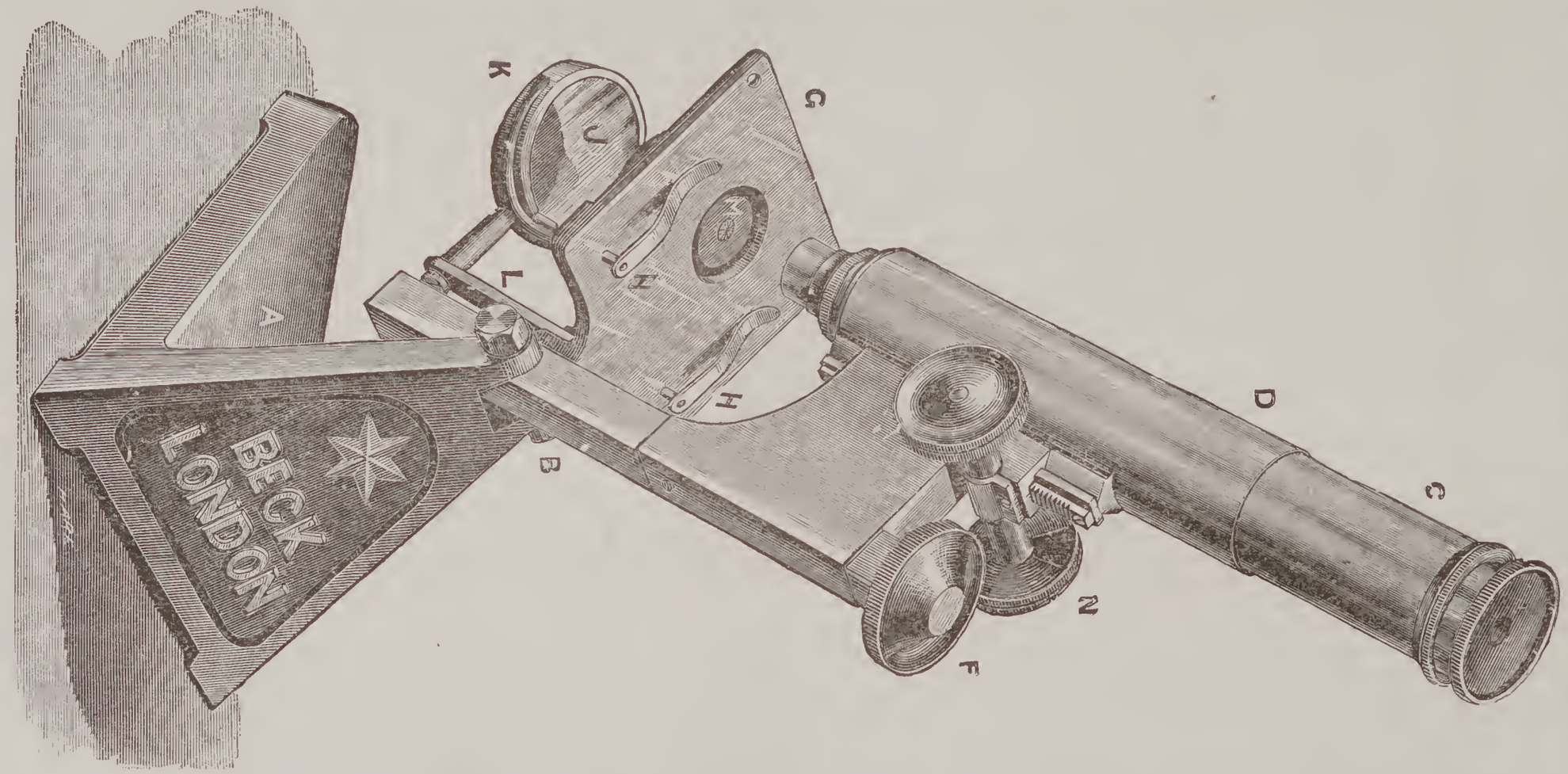

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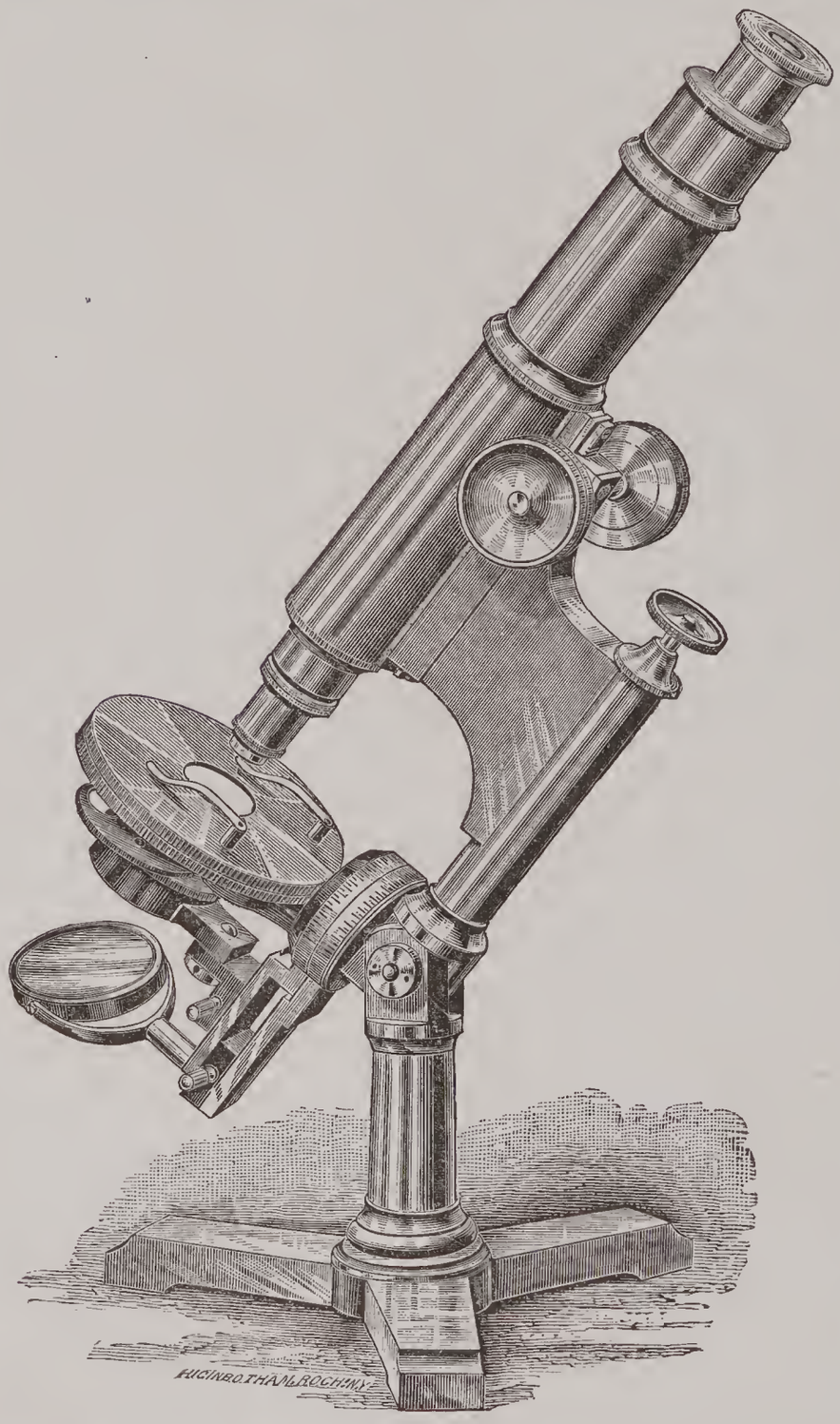

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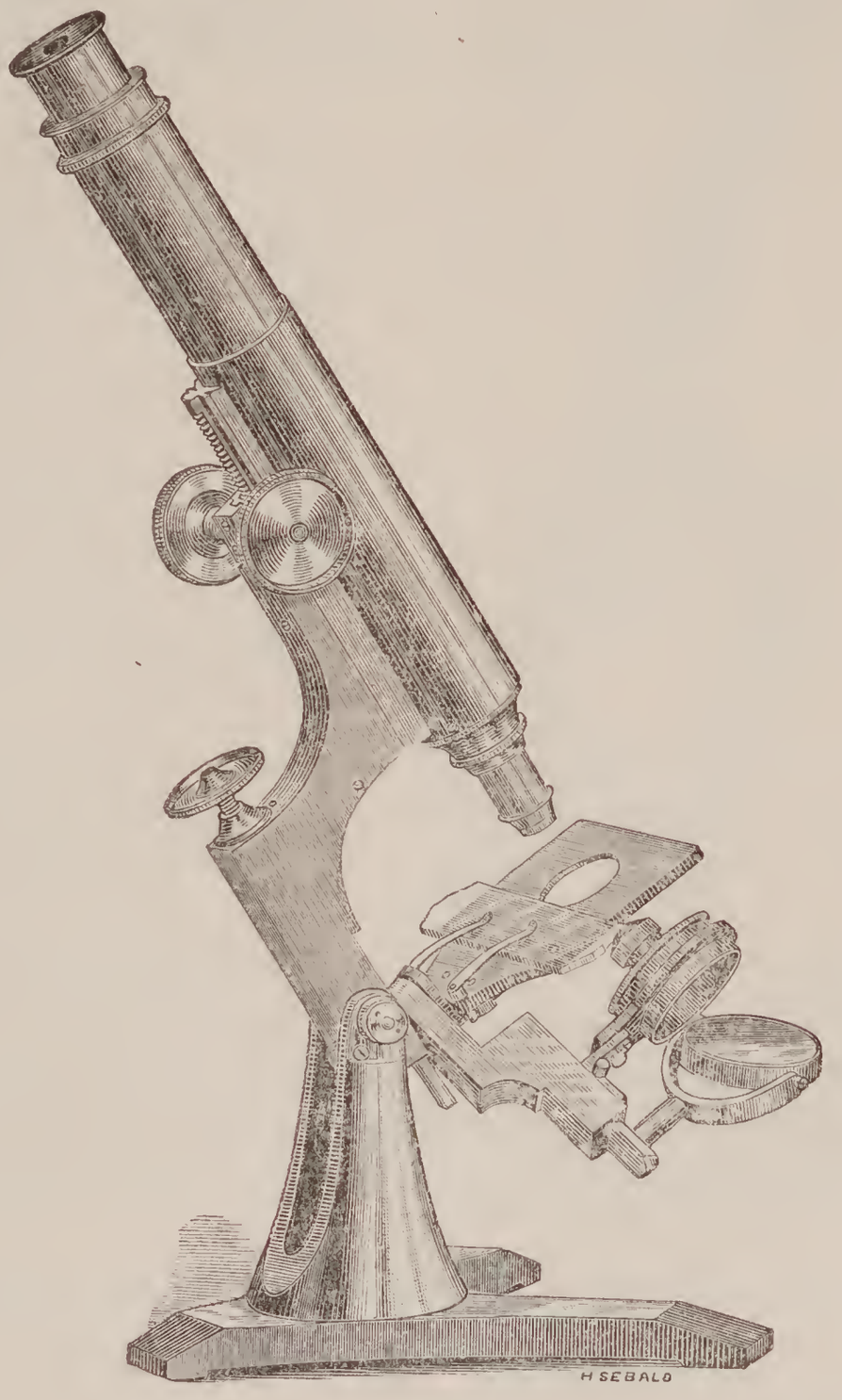

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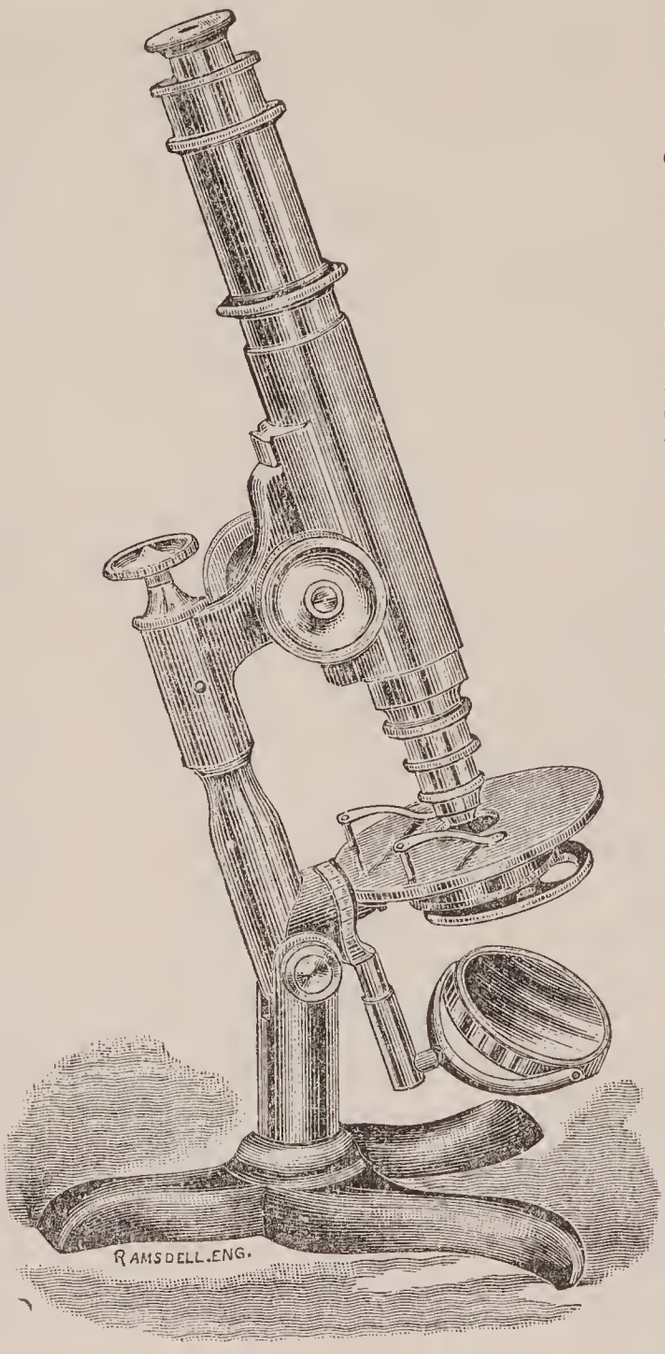

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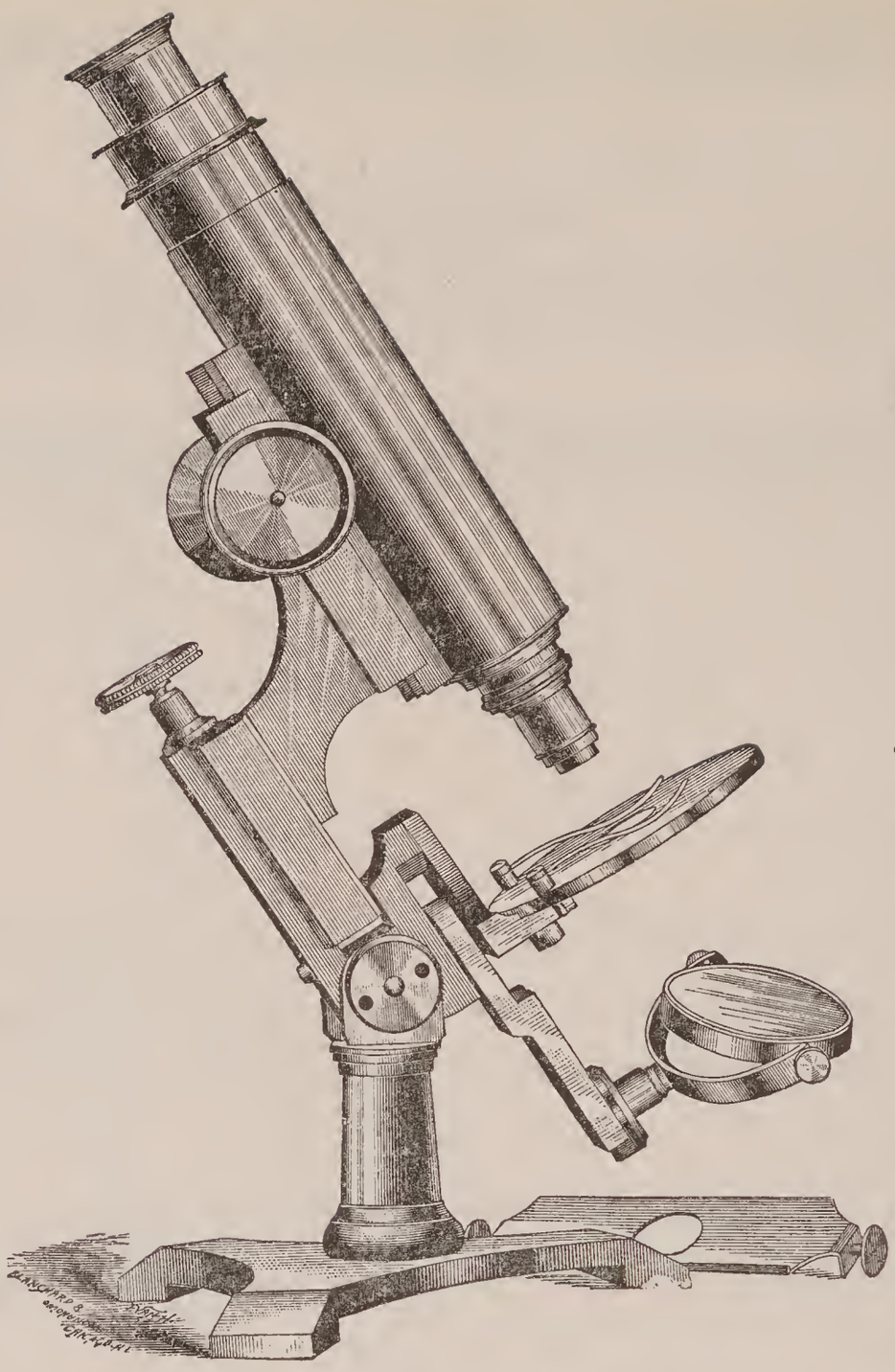

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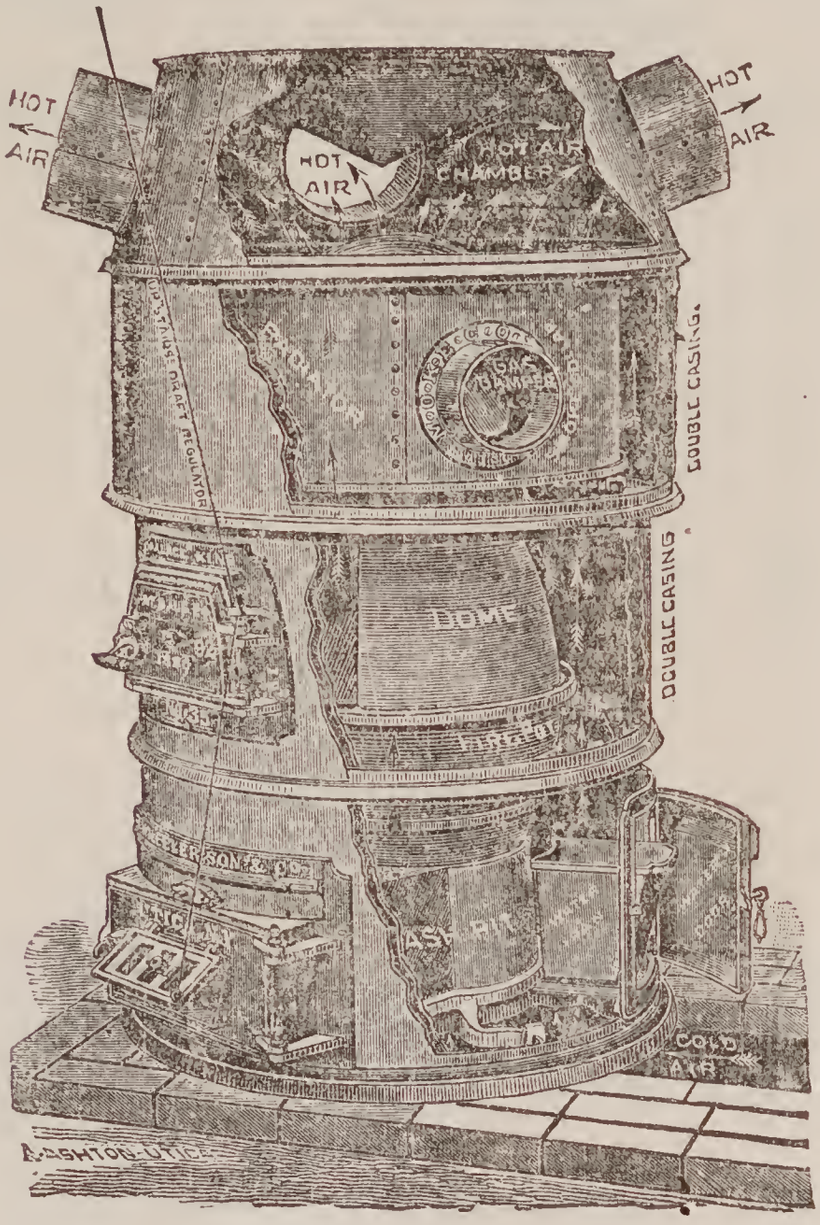

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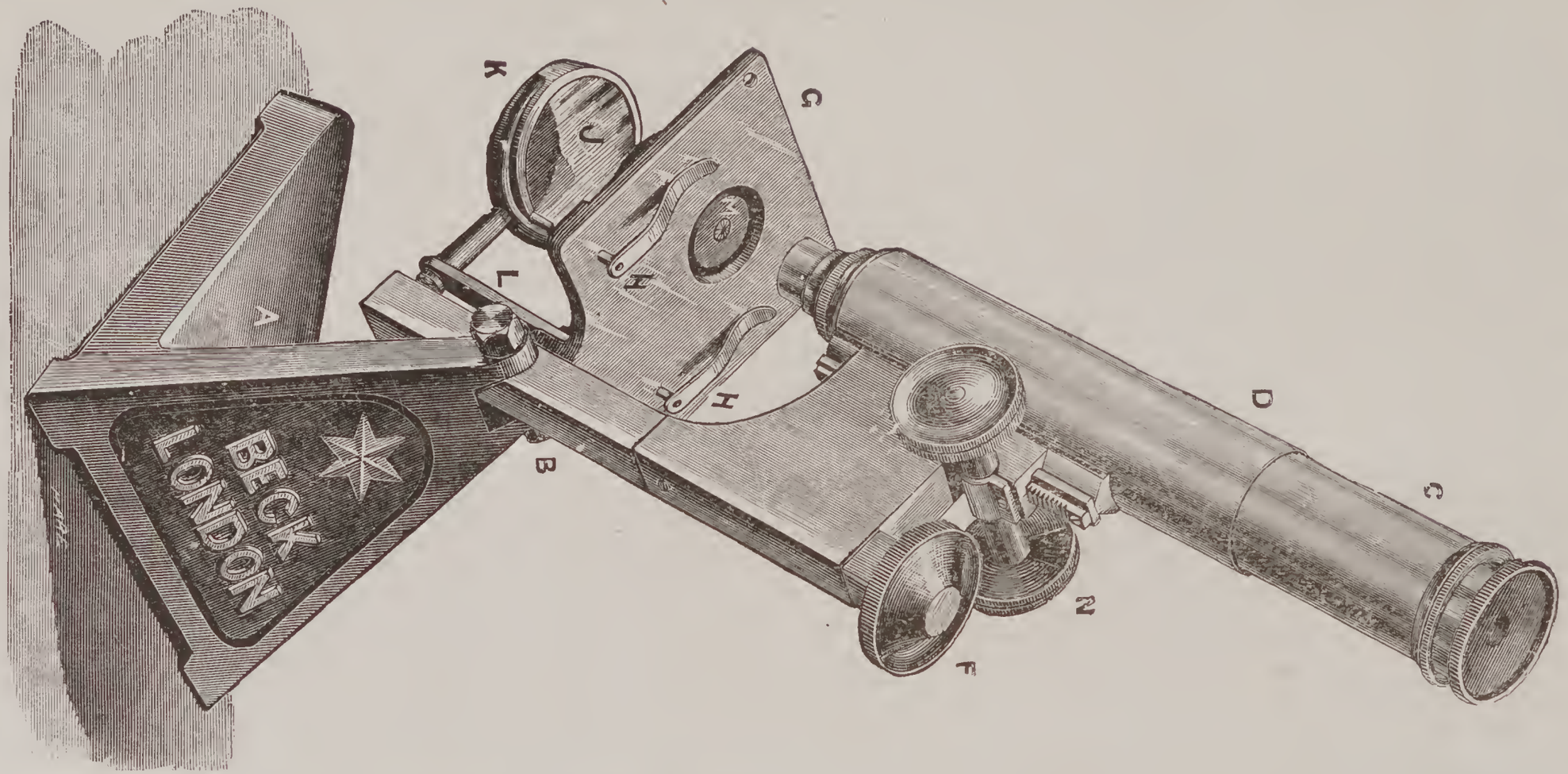

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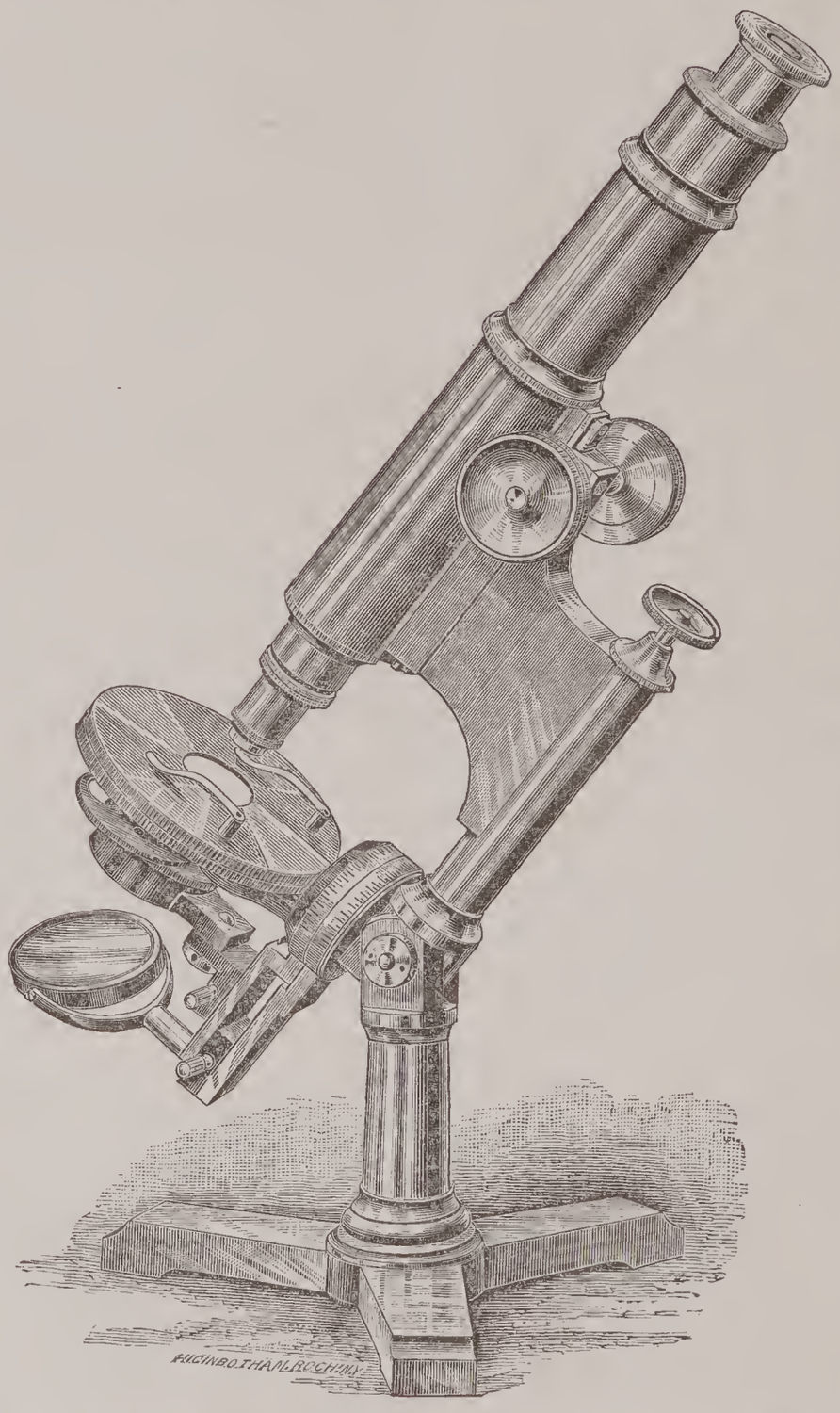

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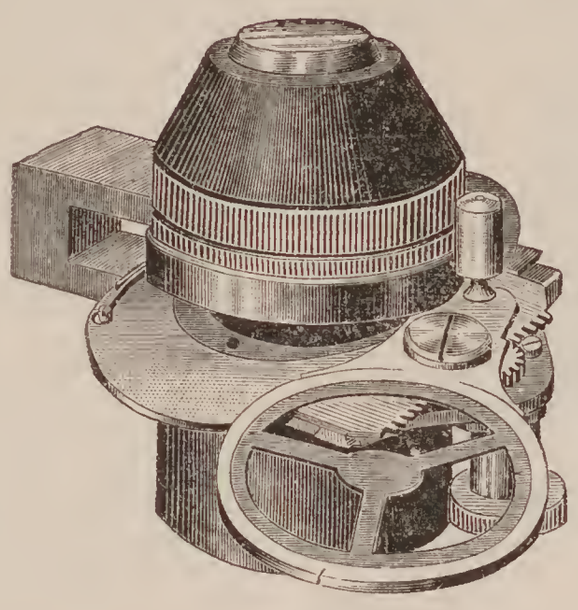

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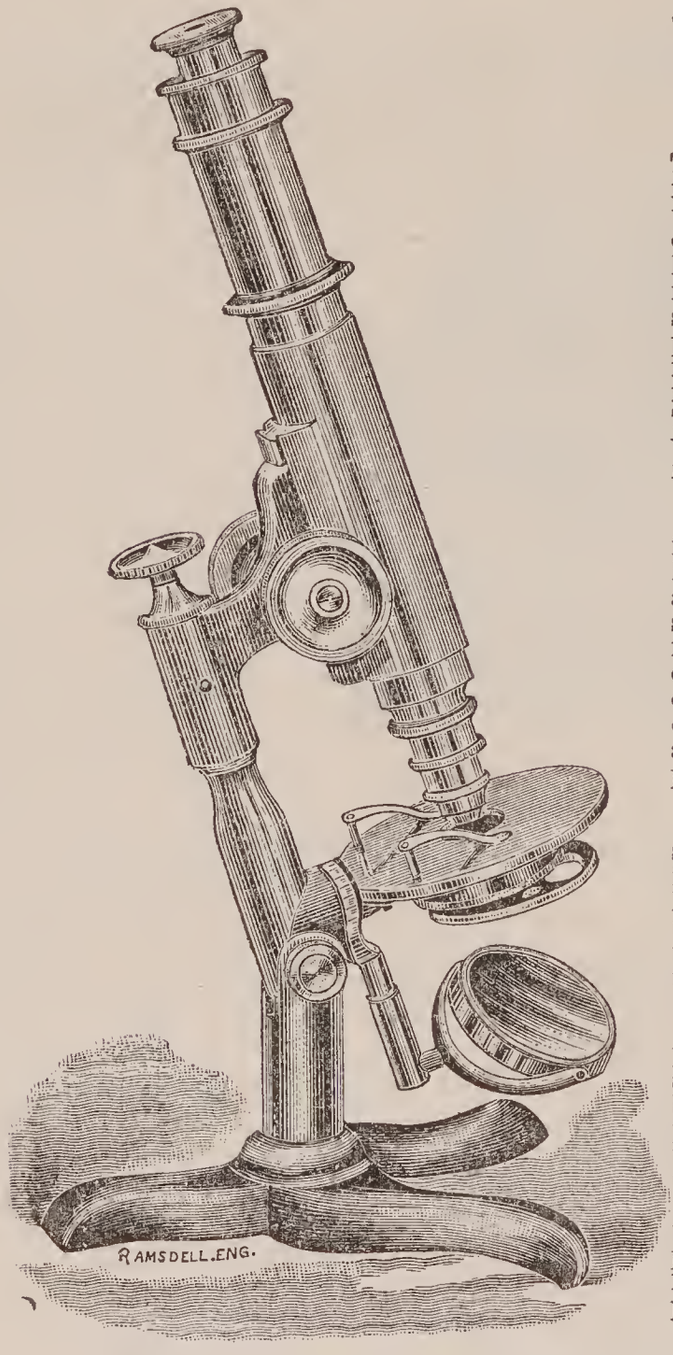

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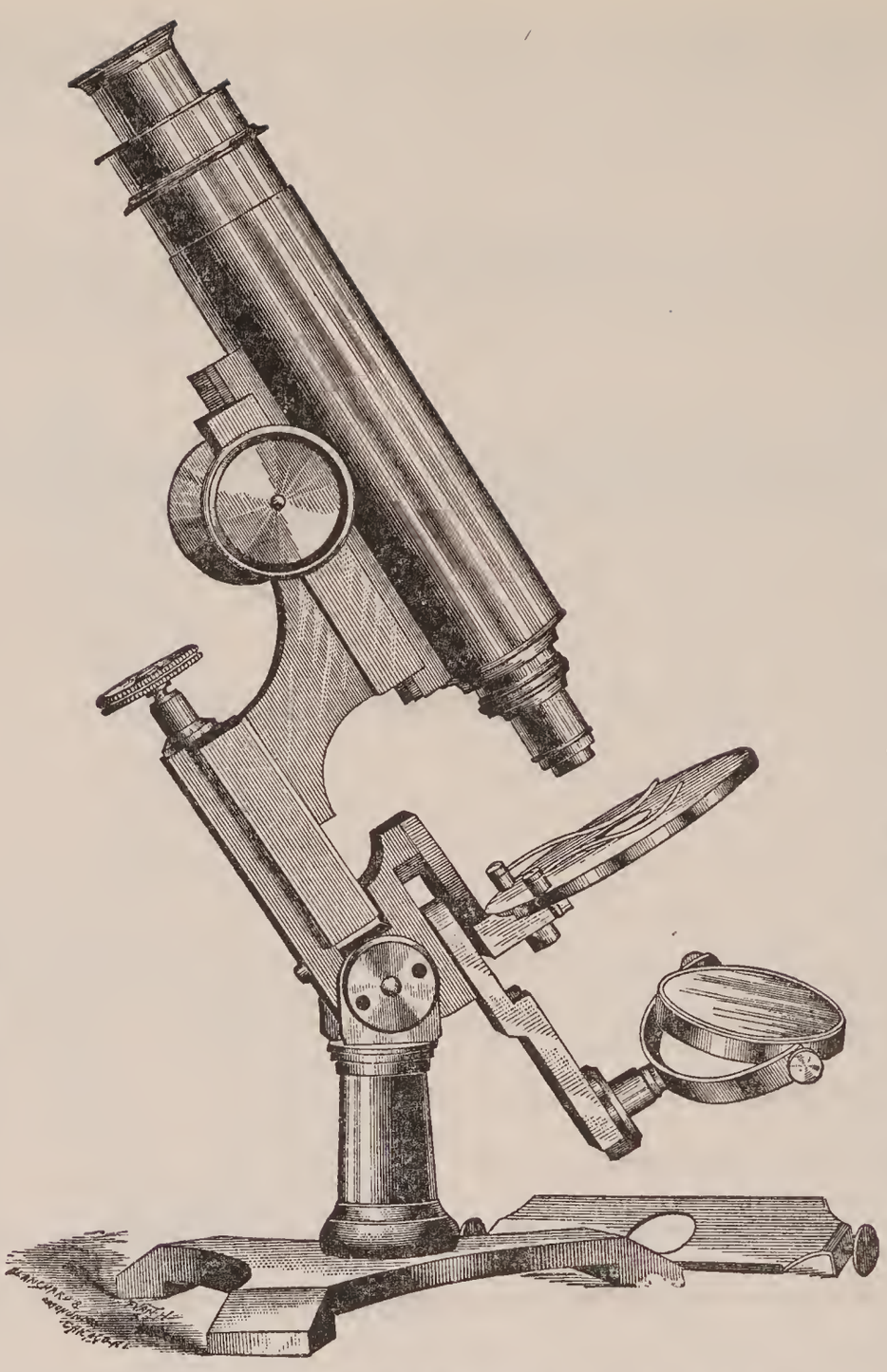

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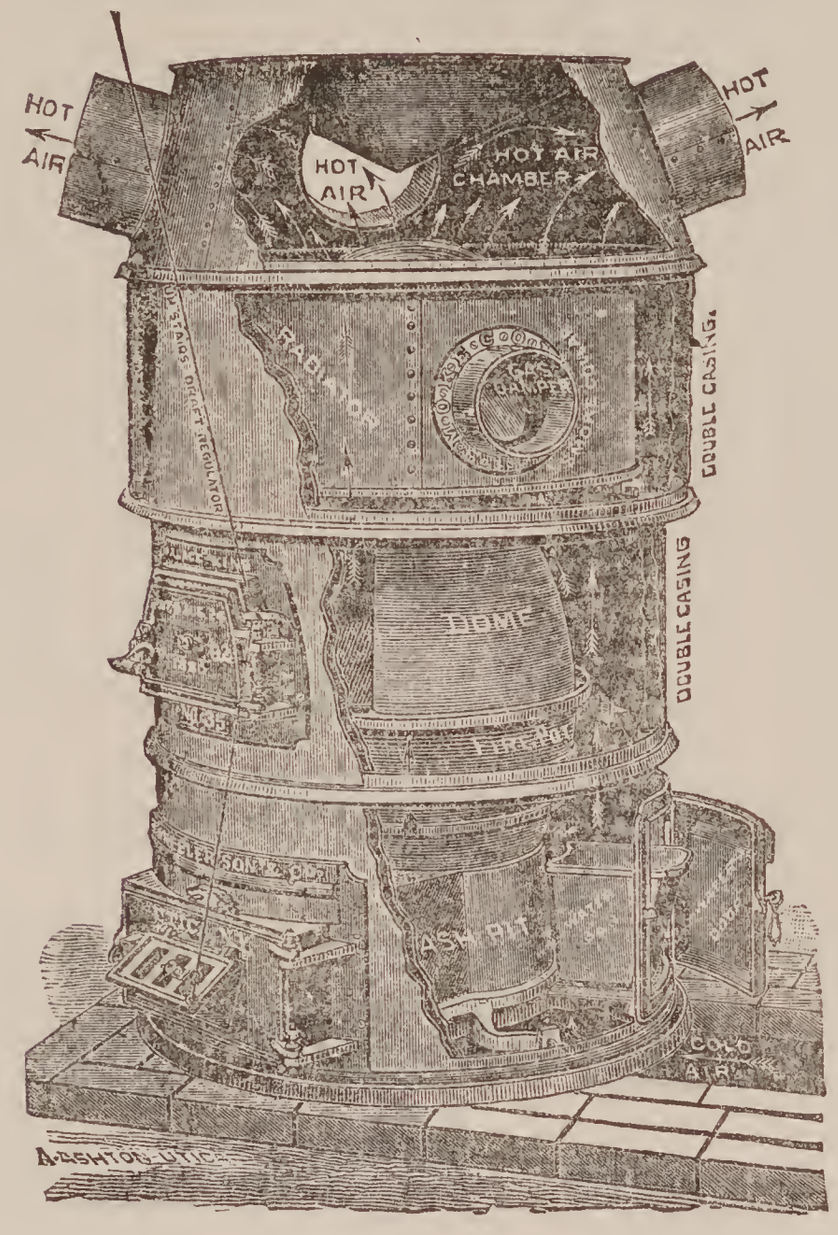

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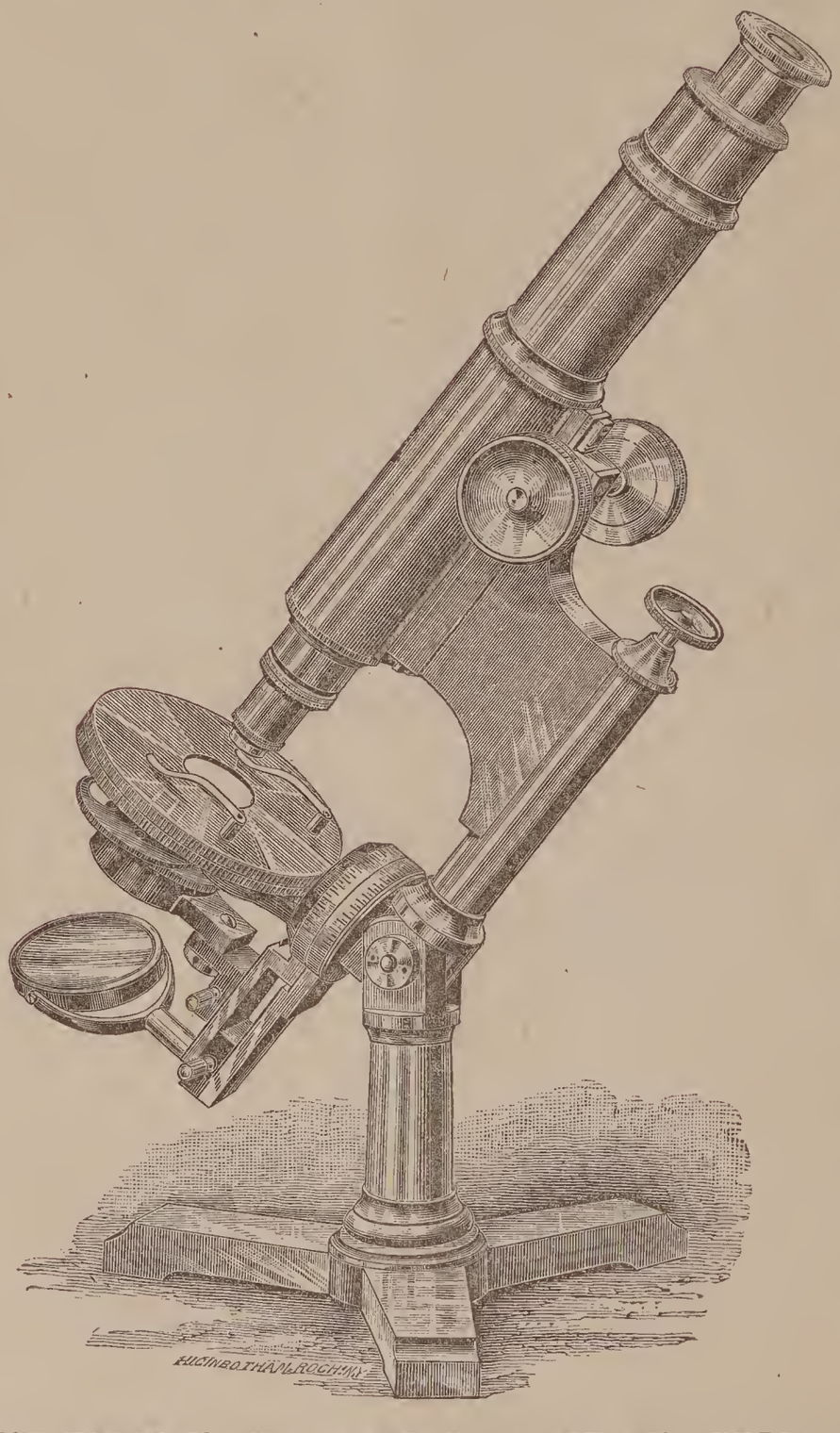

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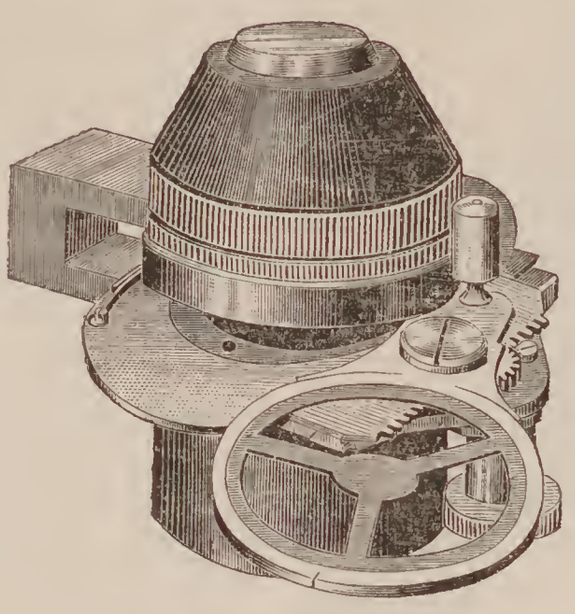

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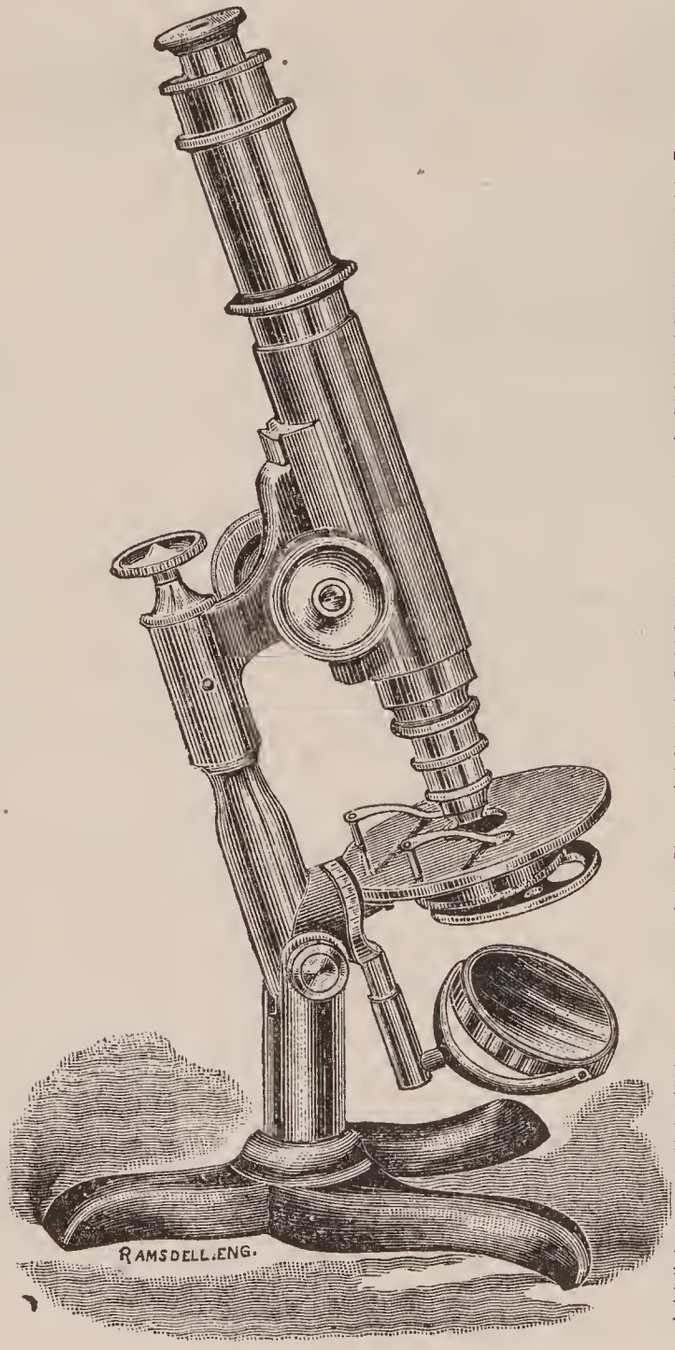

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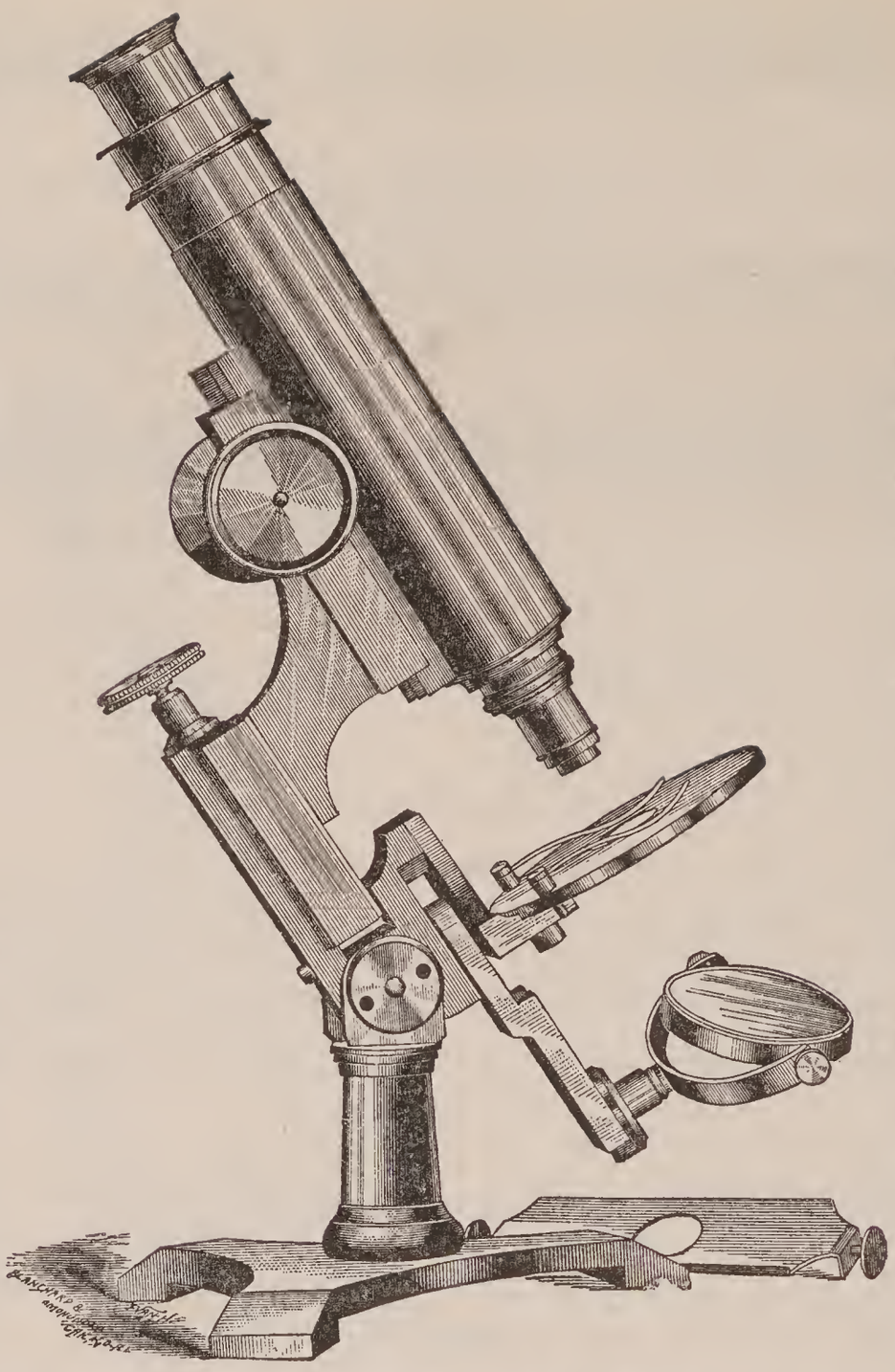

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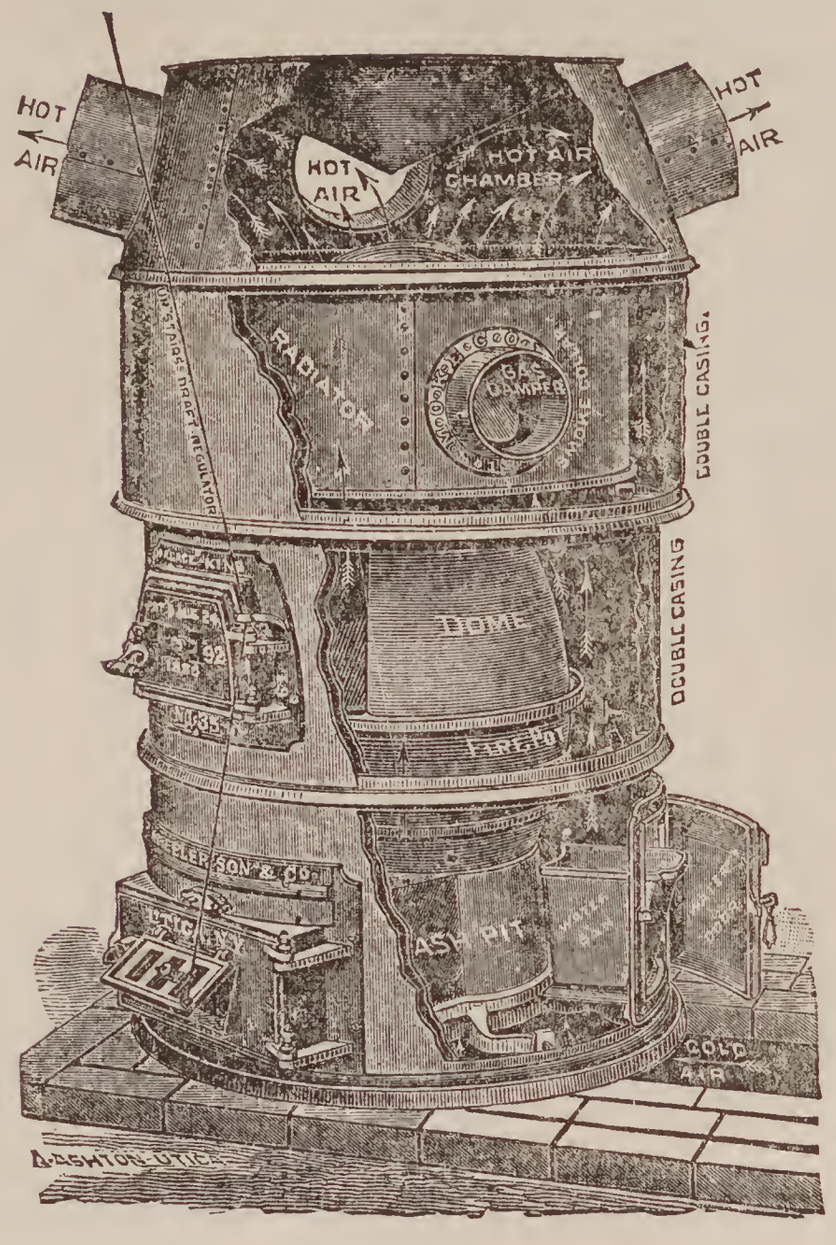

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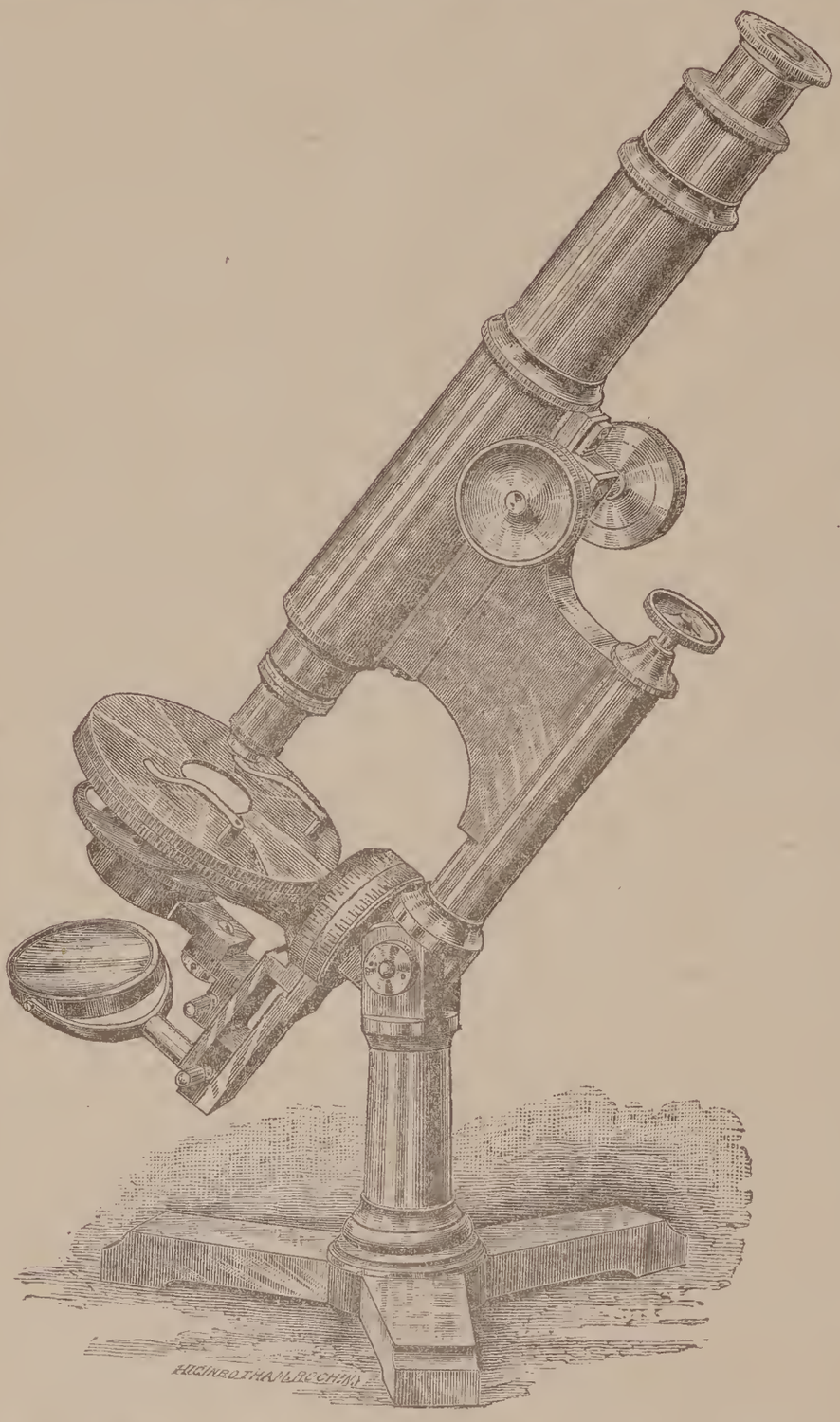

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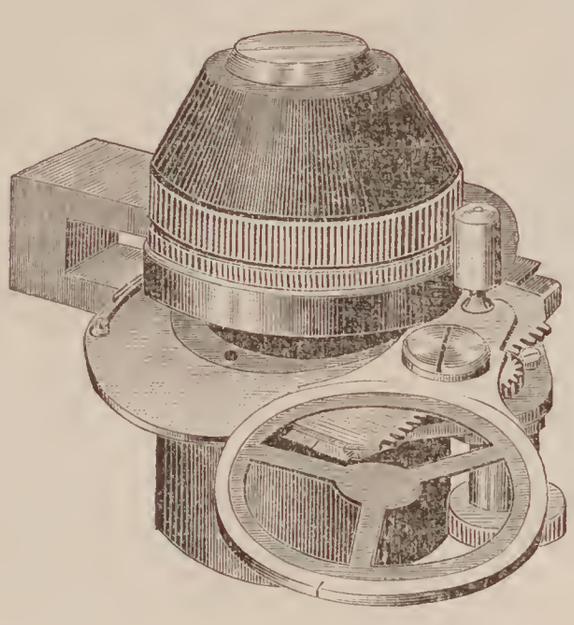

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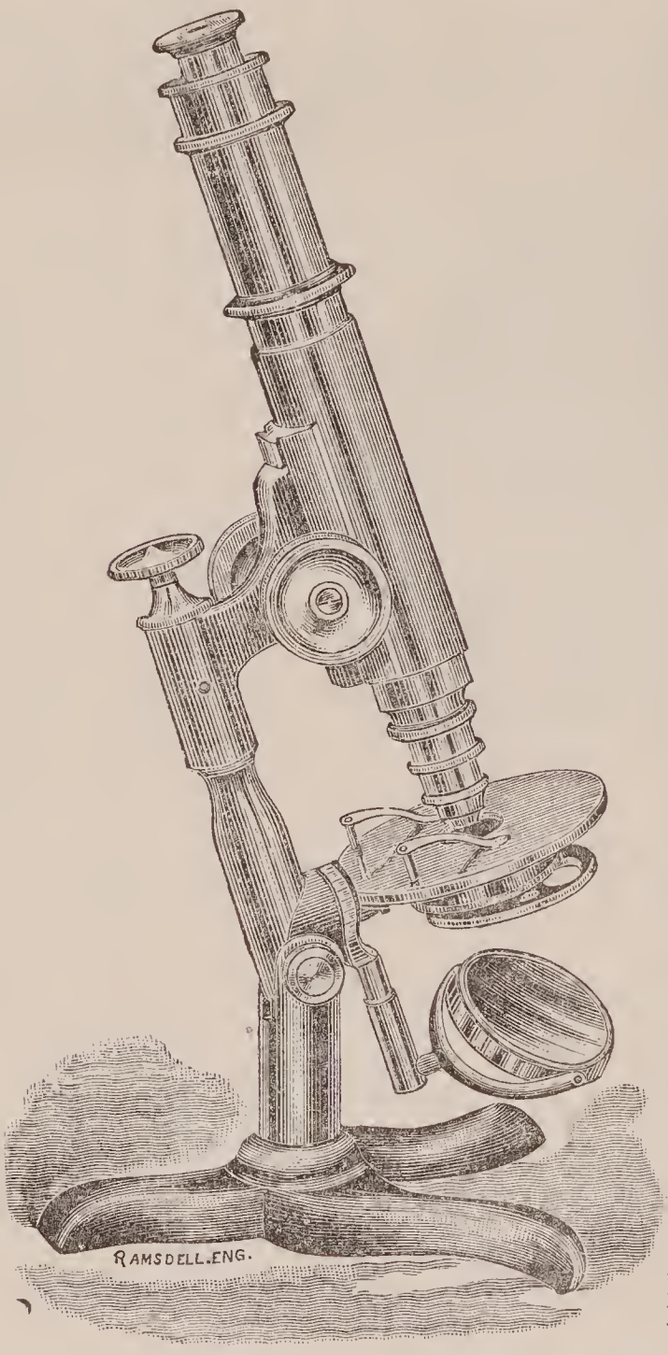

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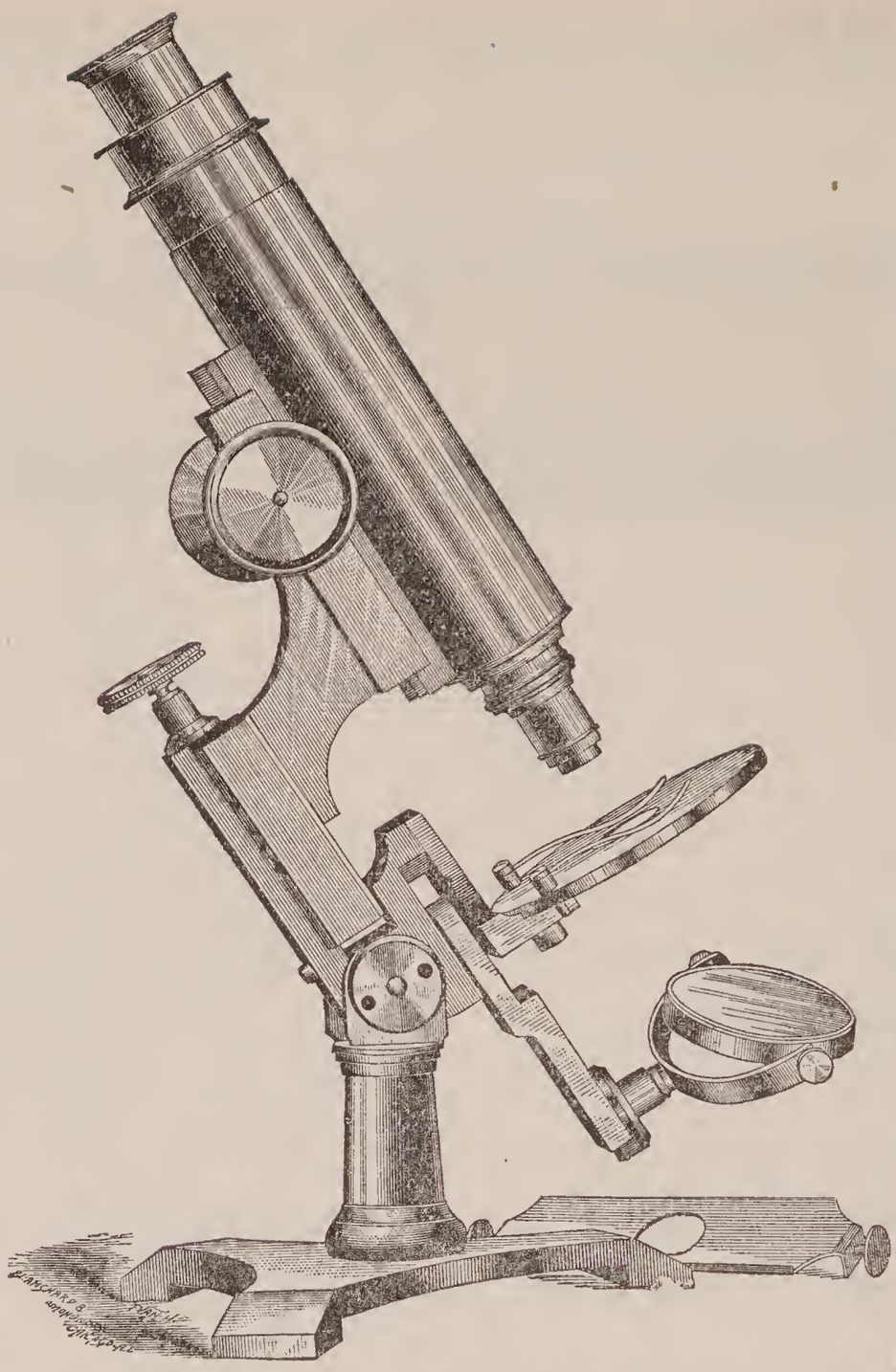

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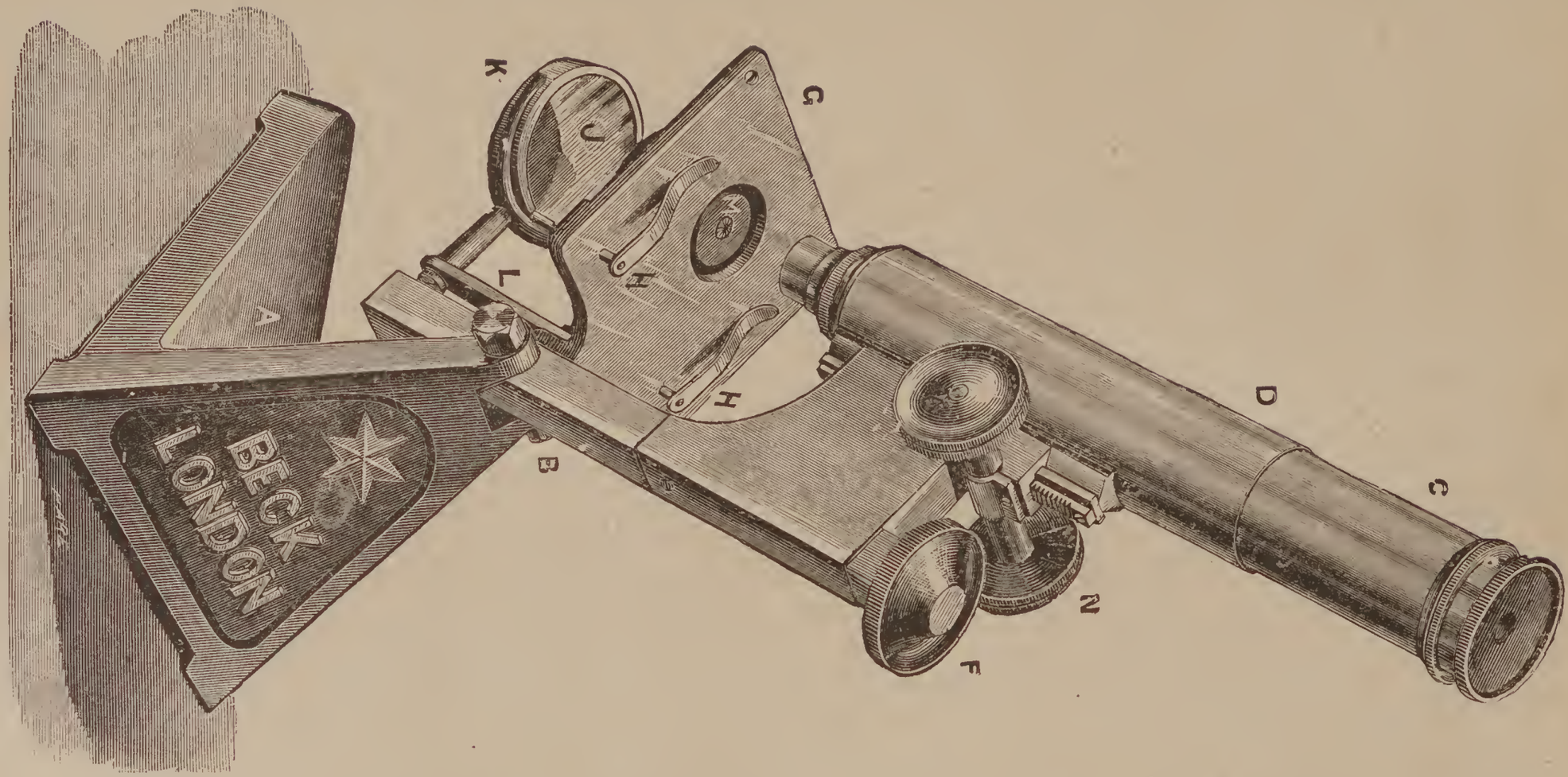

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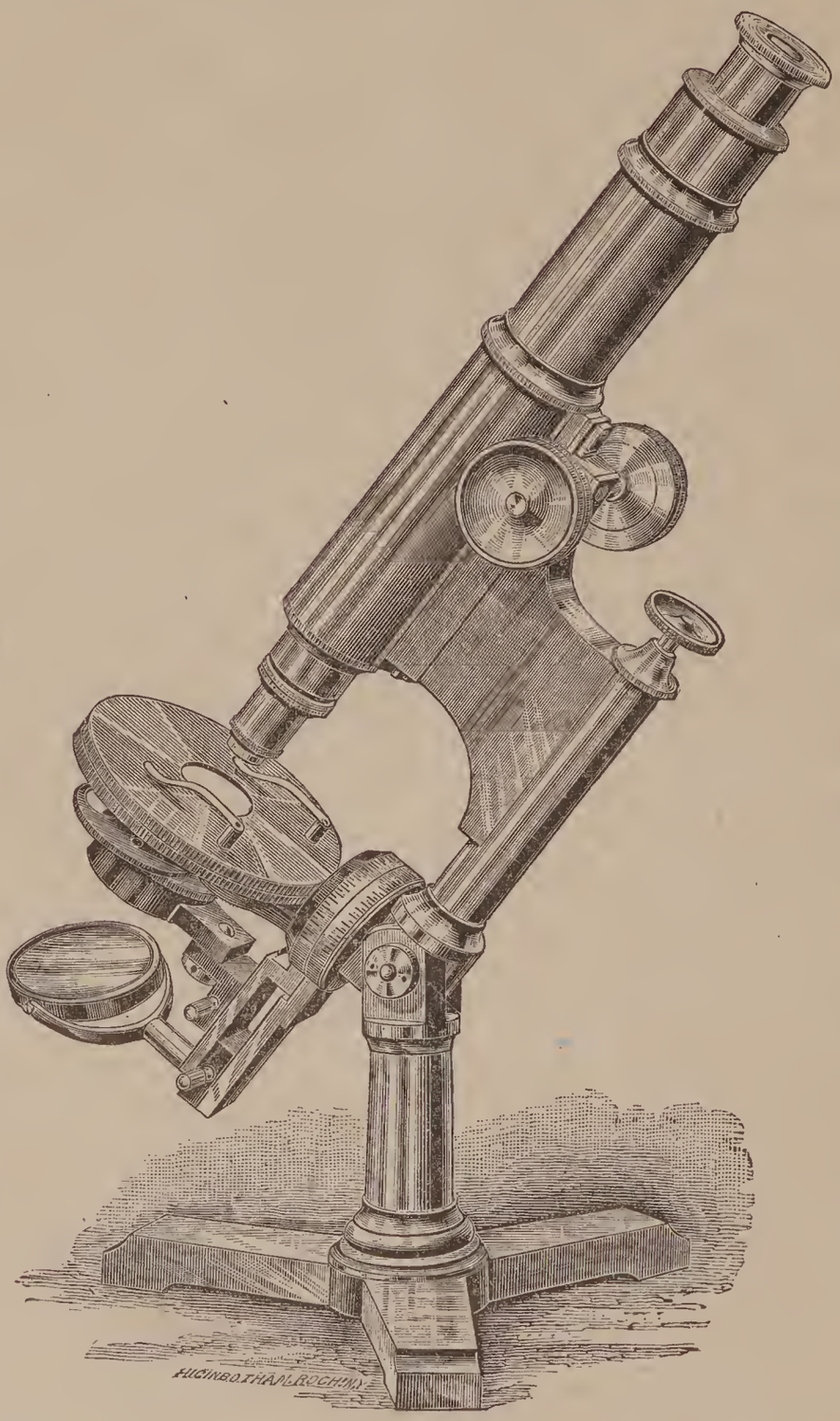

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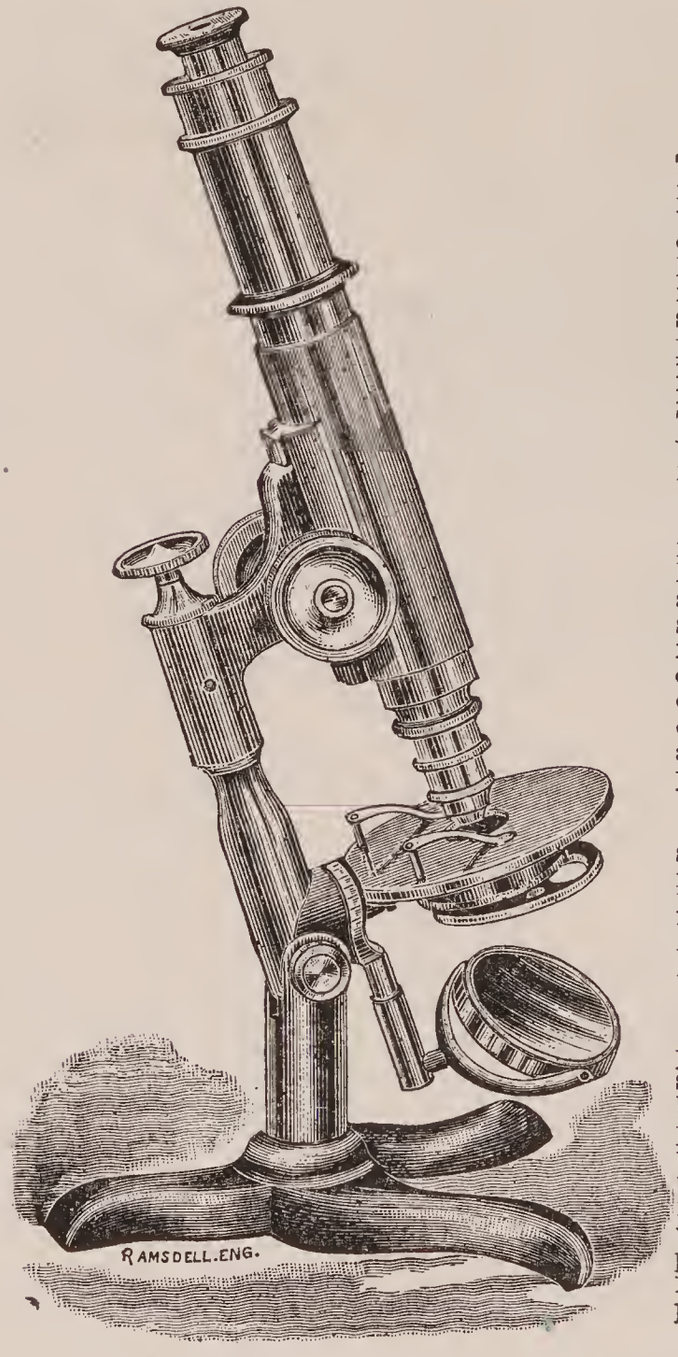

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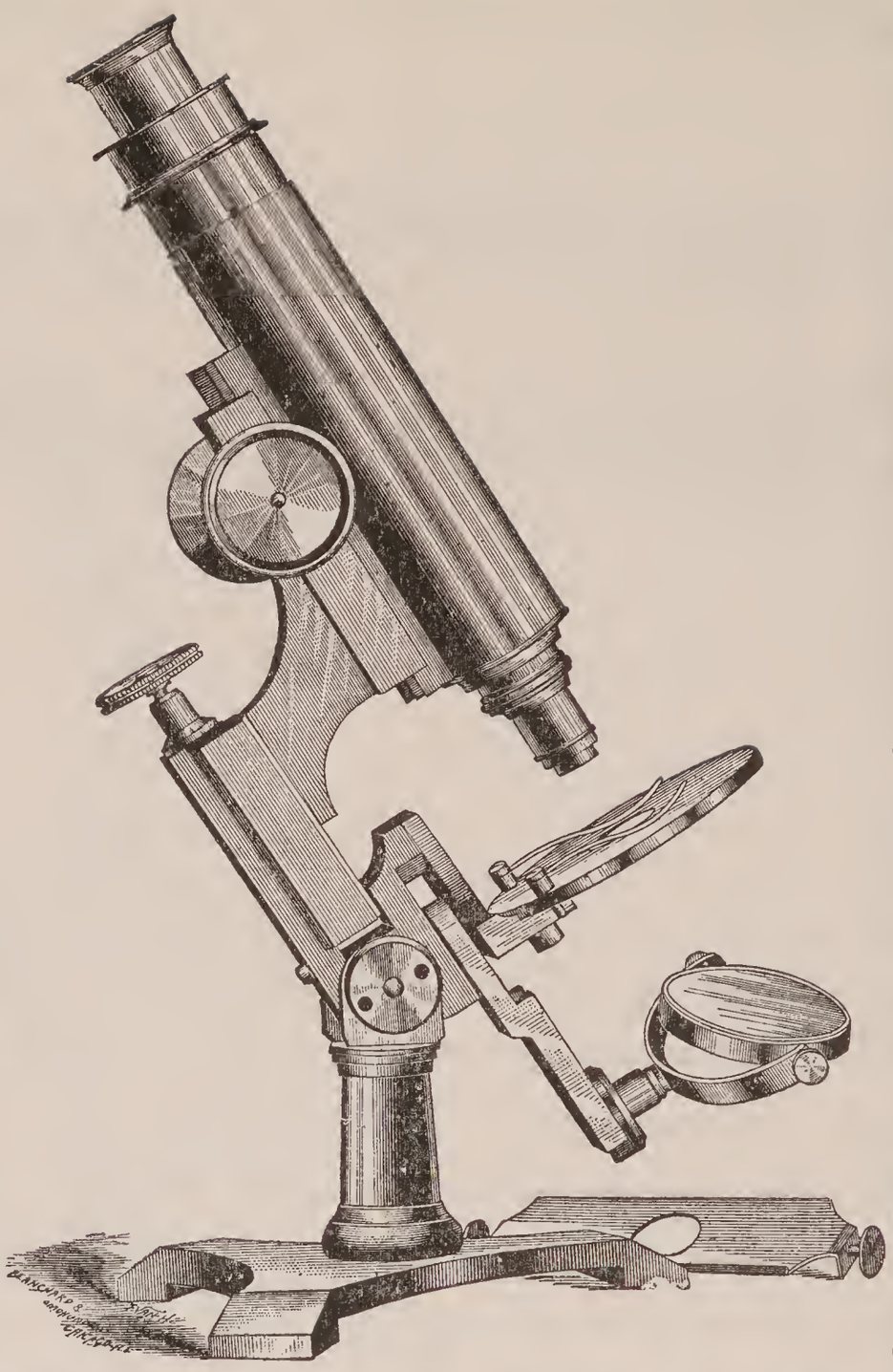

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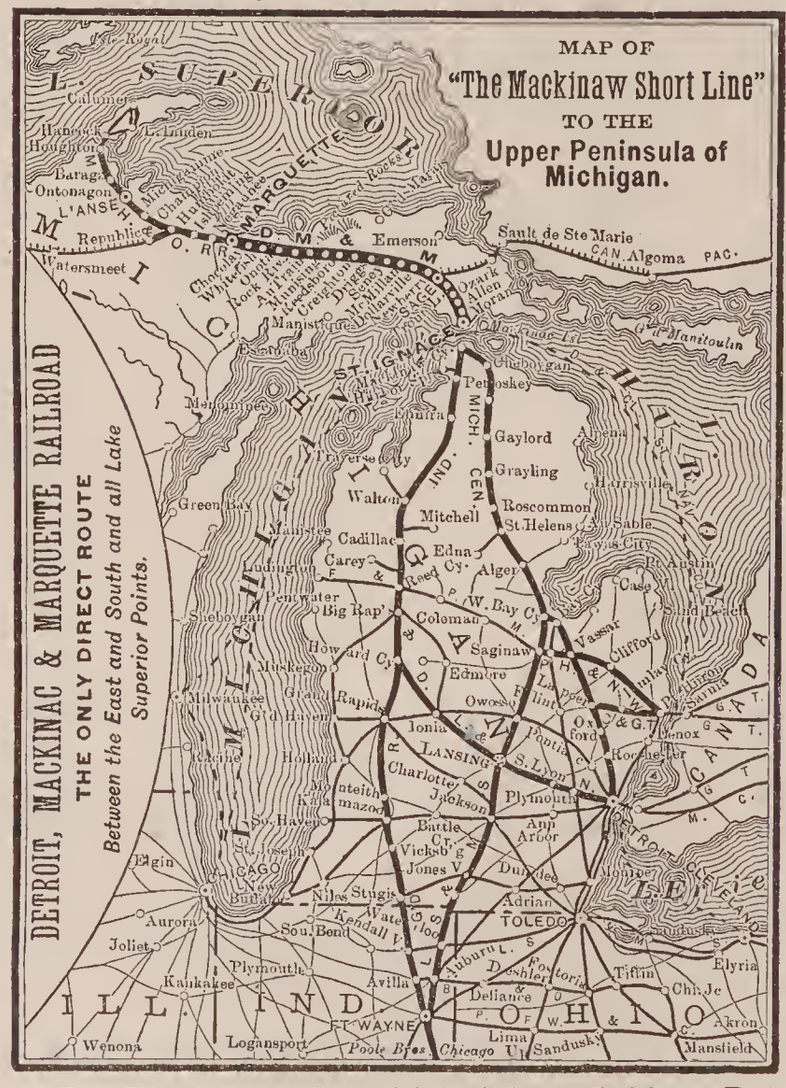

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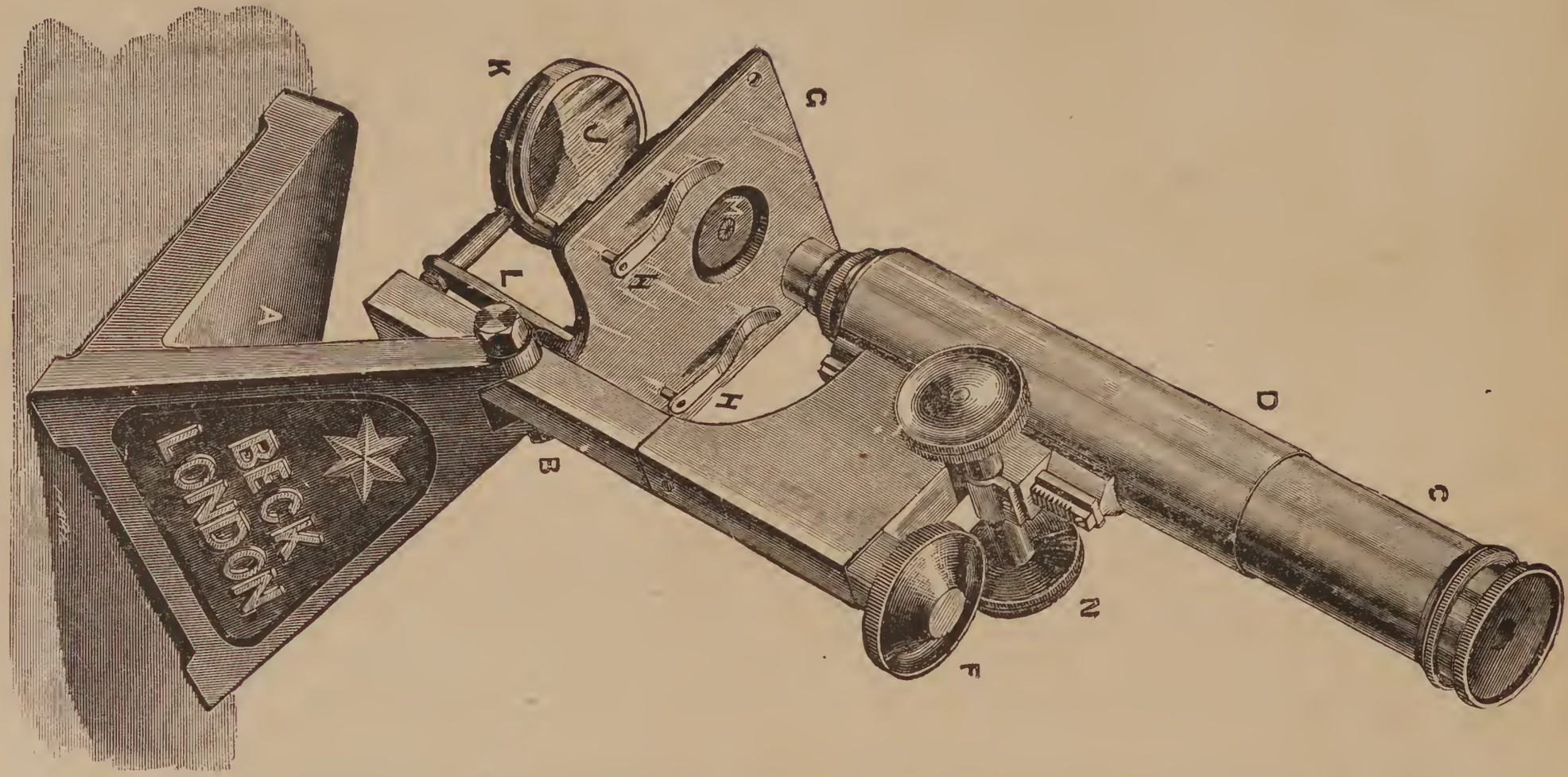

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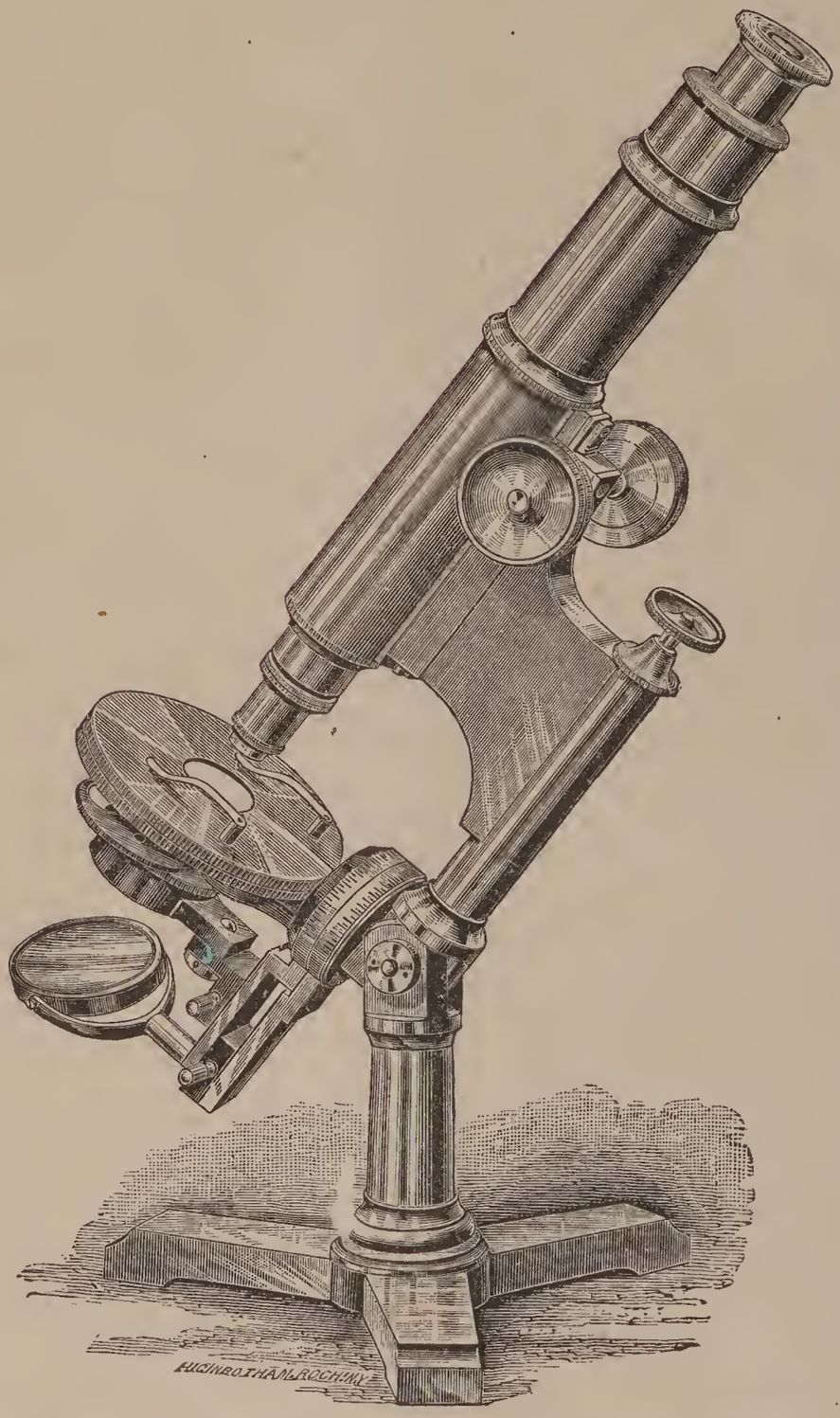

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EDITED AND PUBLISHED BY

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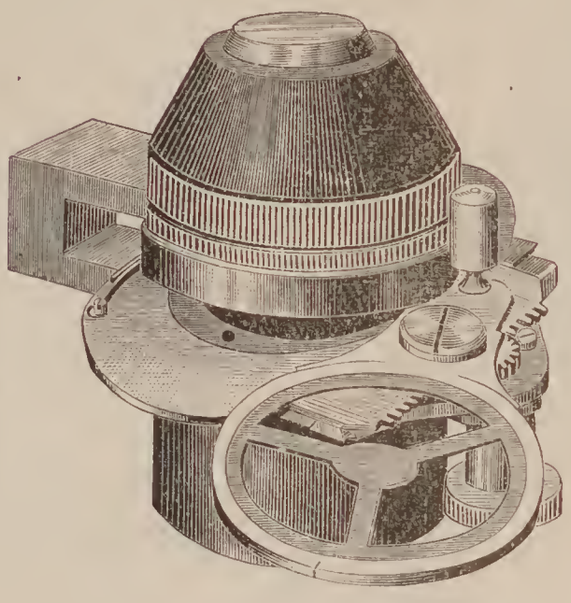

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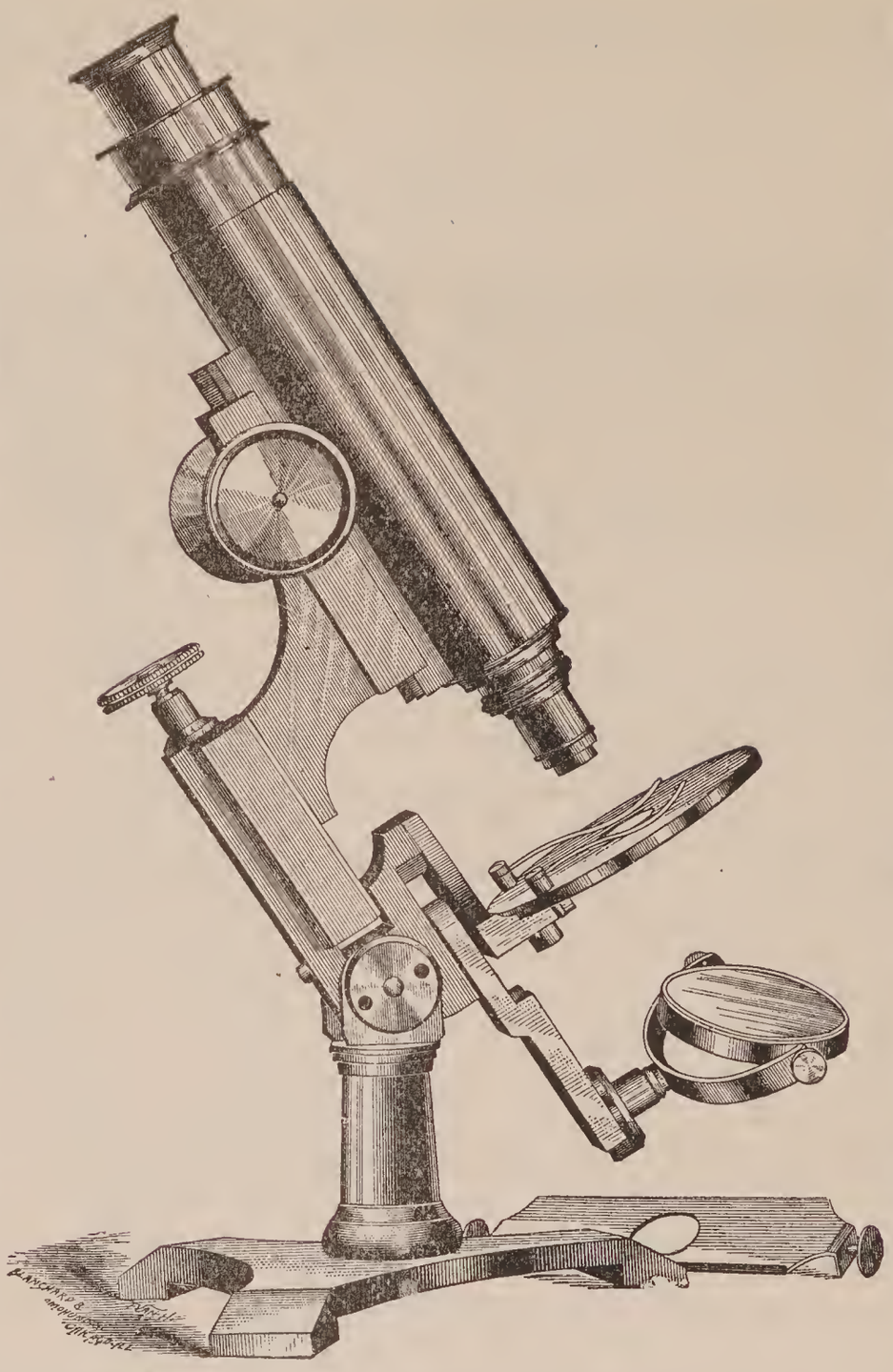

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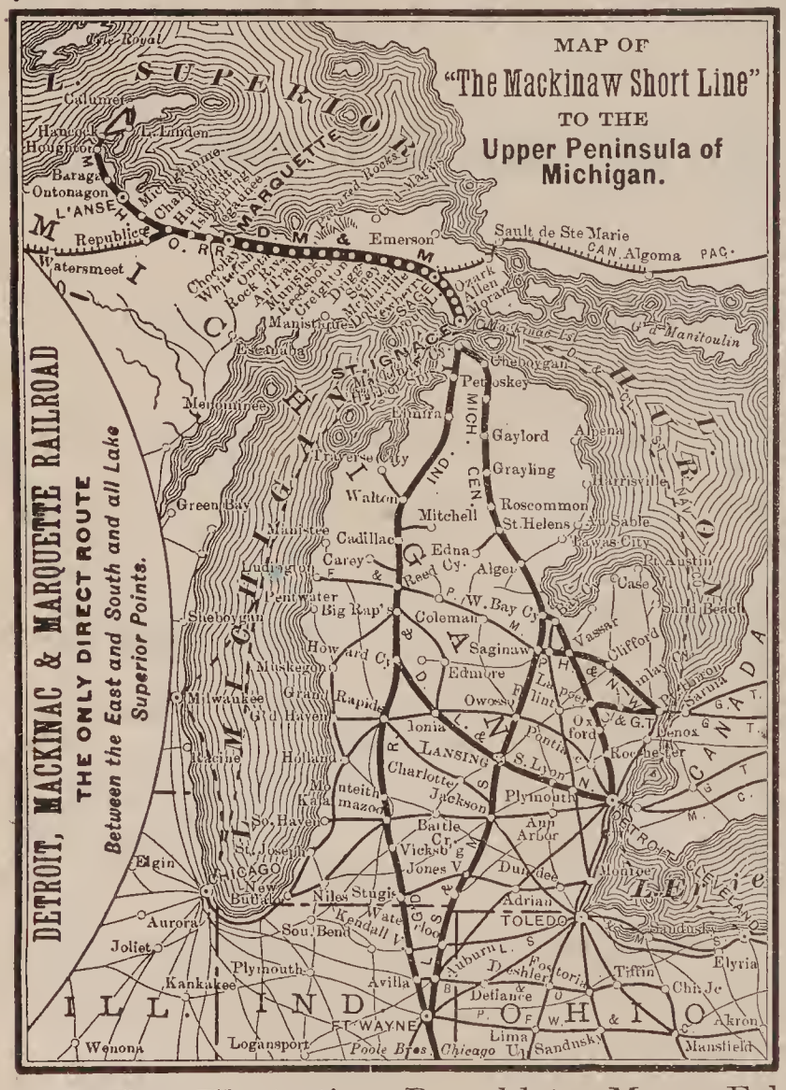

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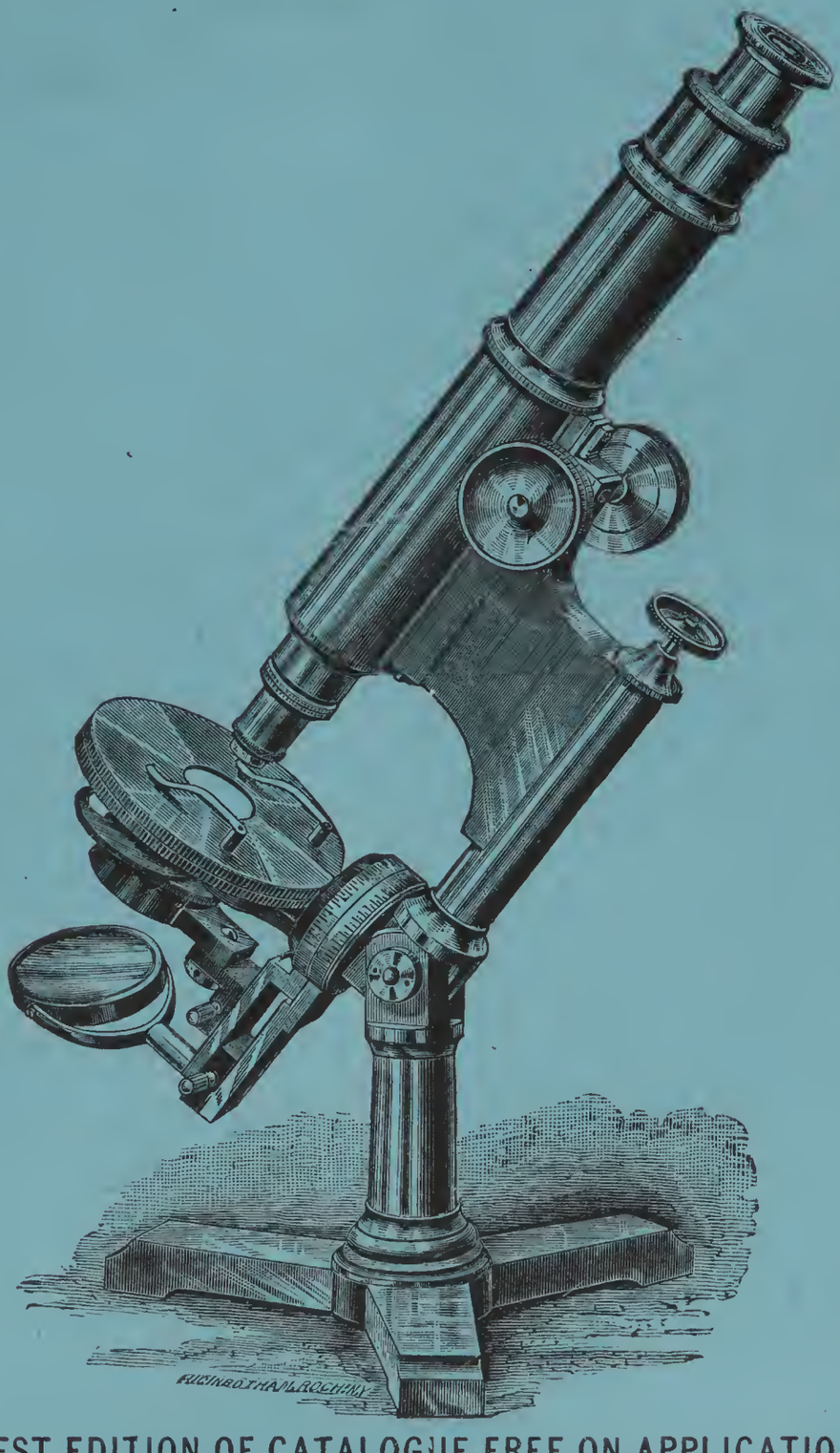

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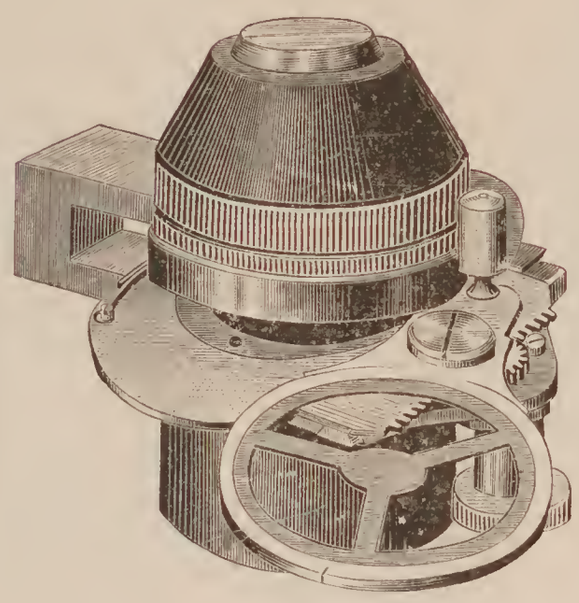

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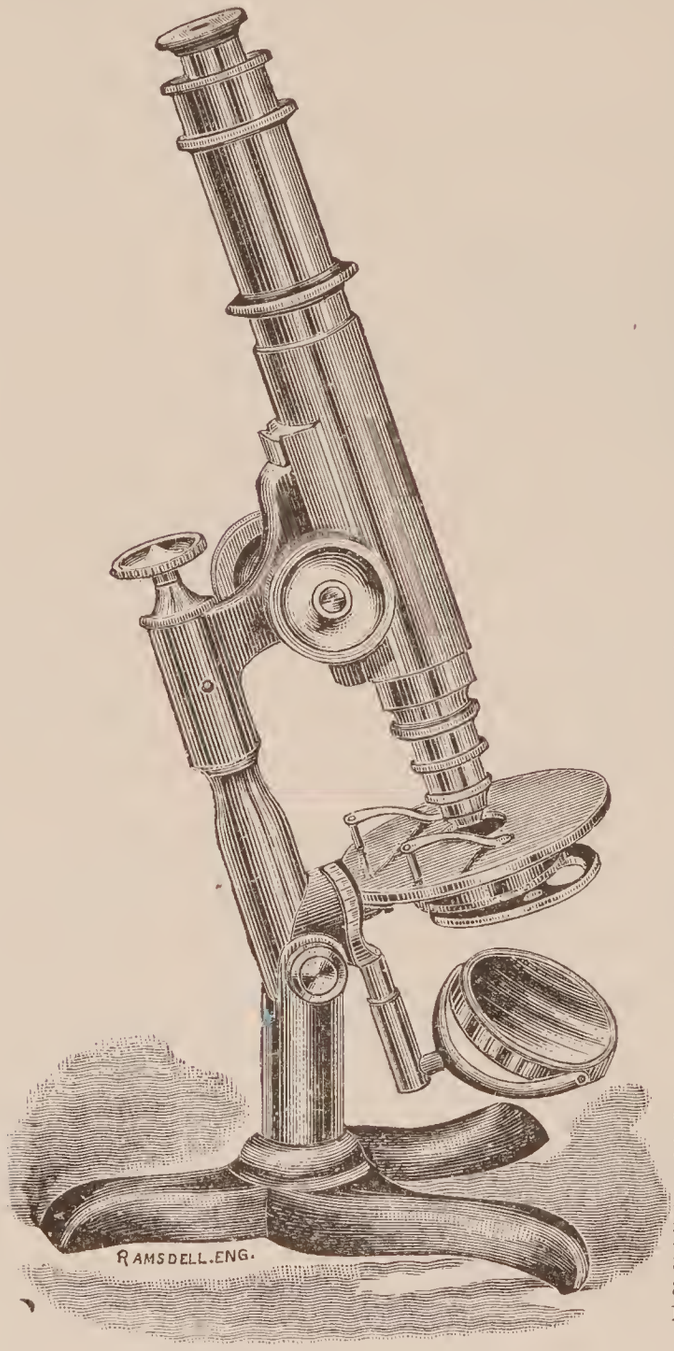

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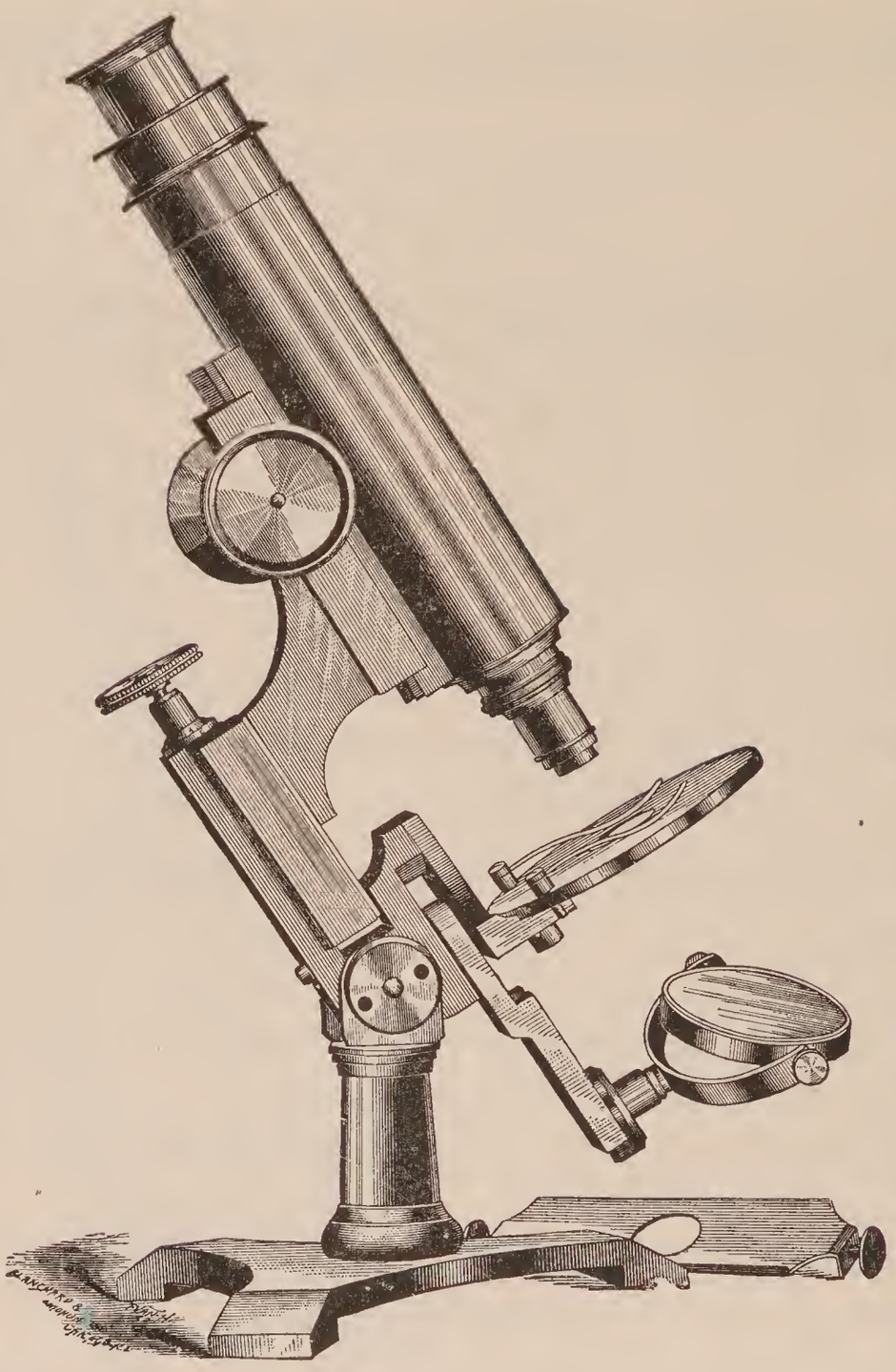

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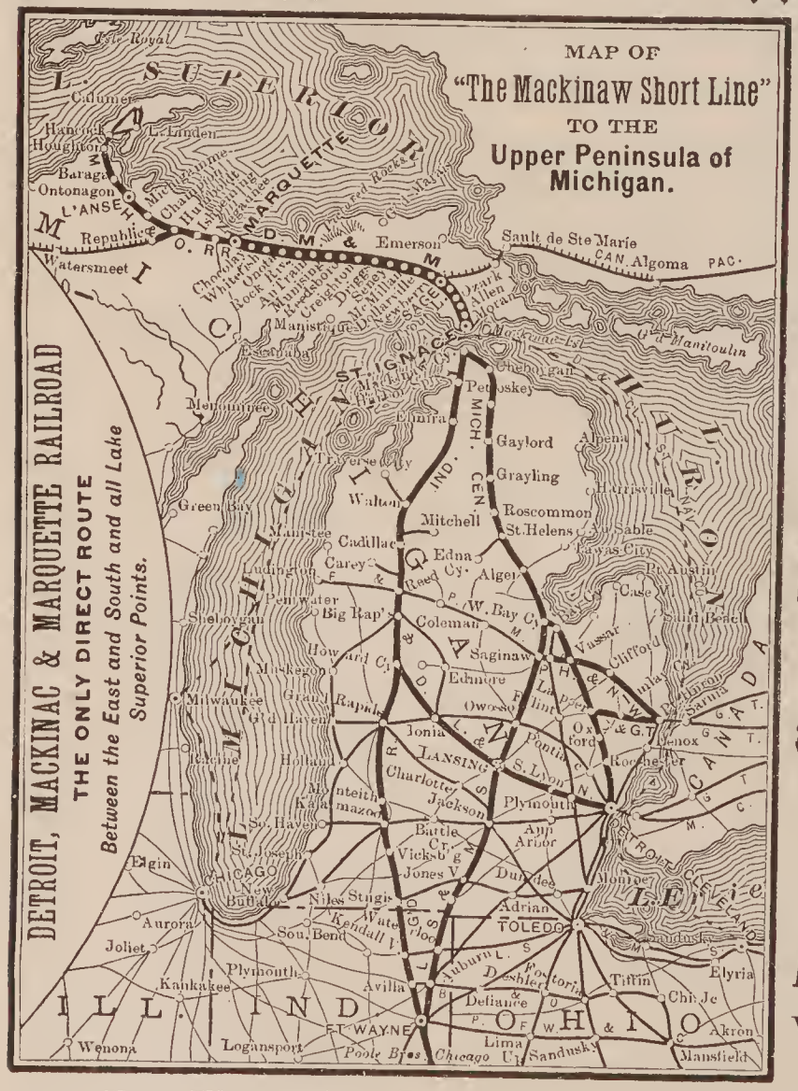

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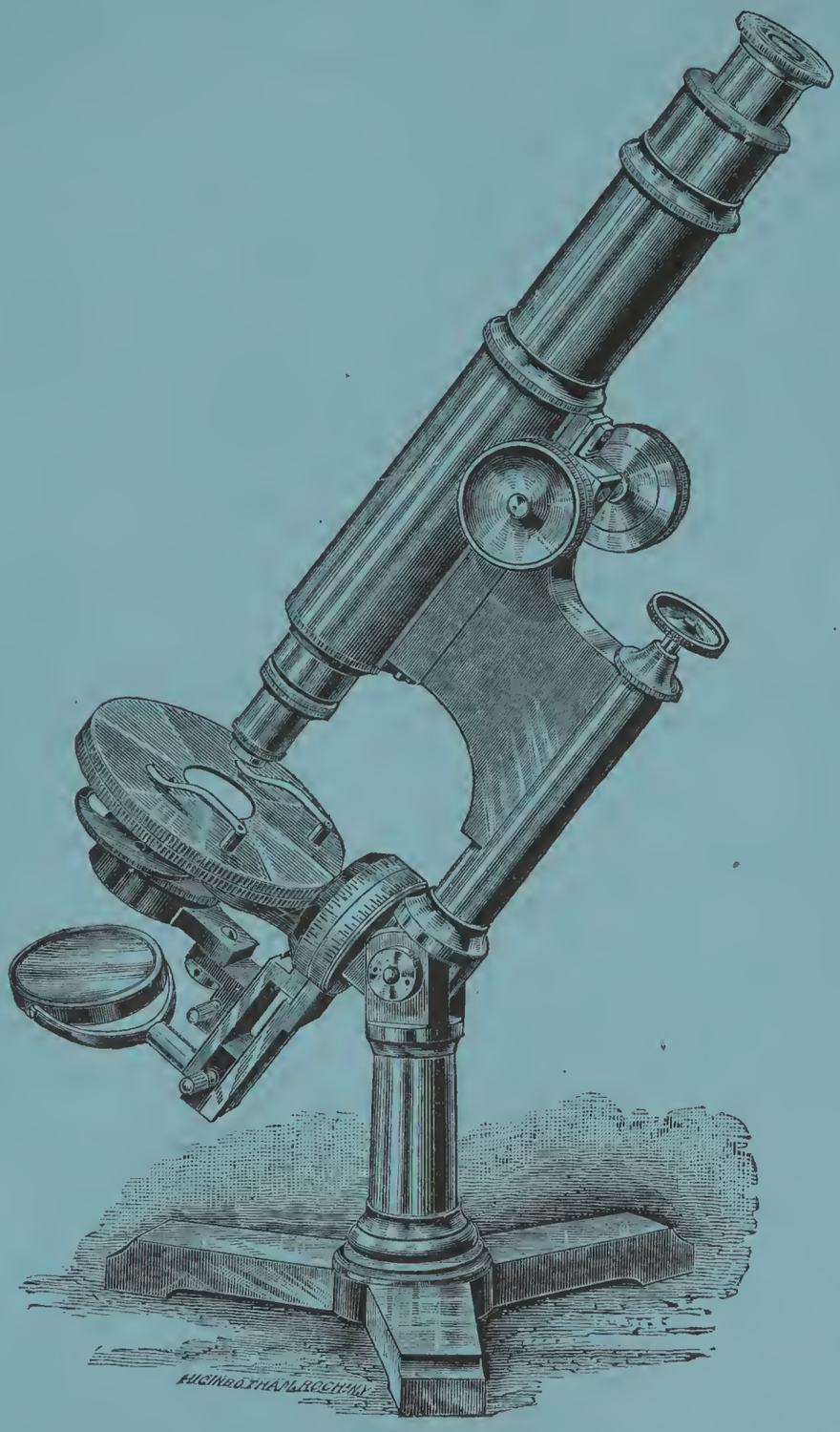

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EDITED AND PUBLISHED BY

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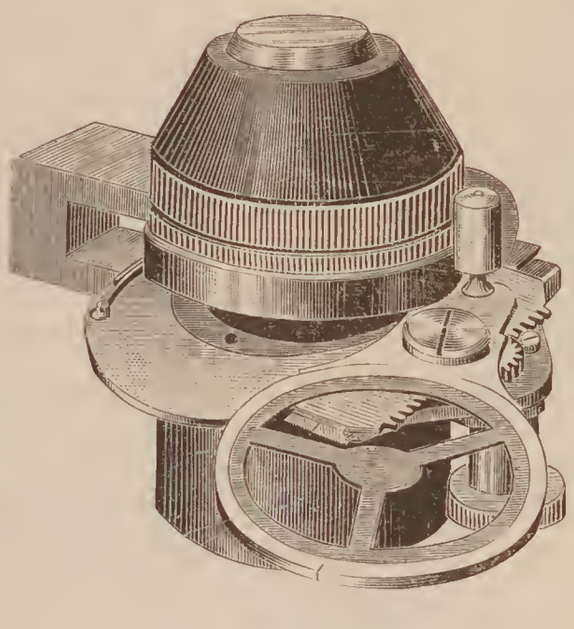

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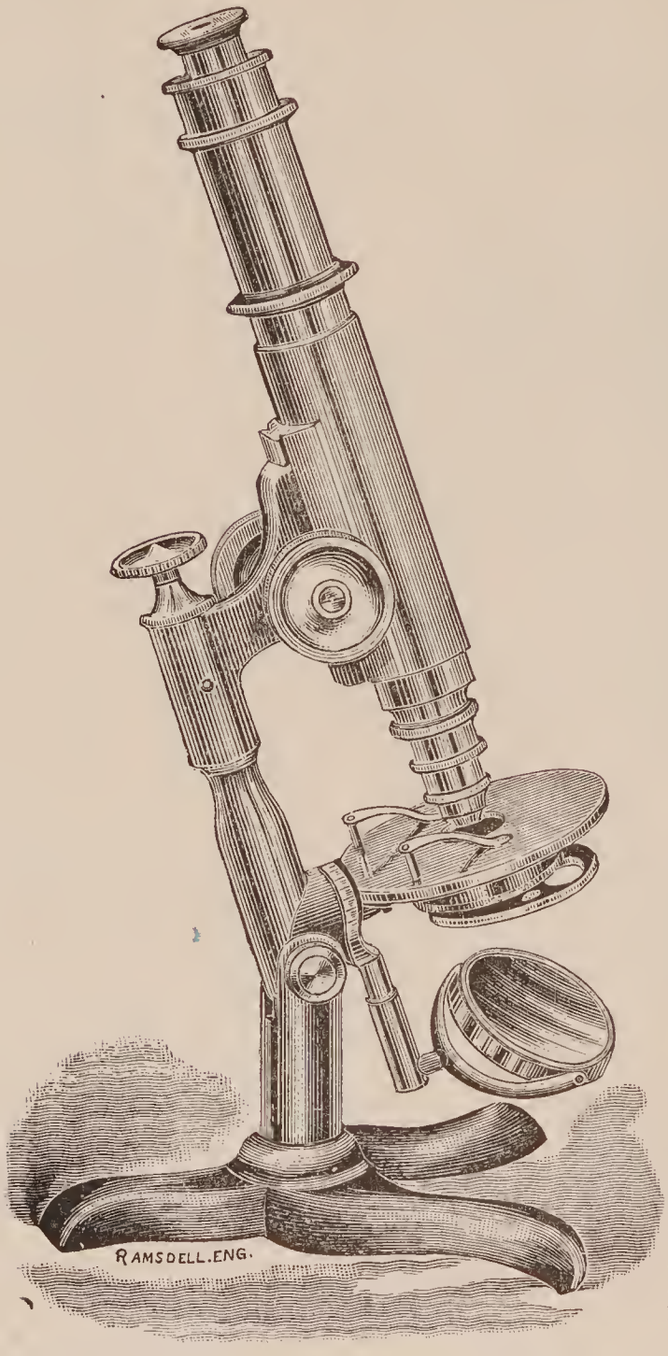

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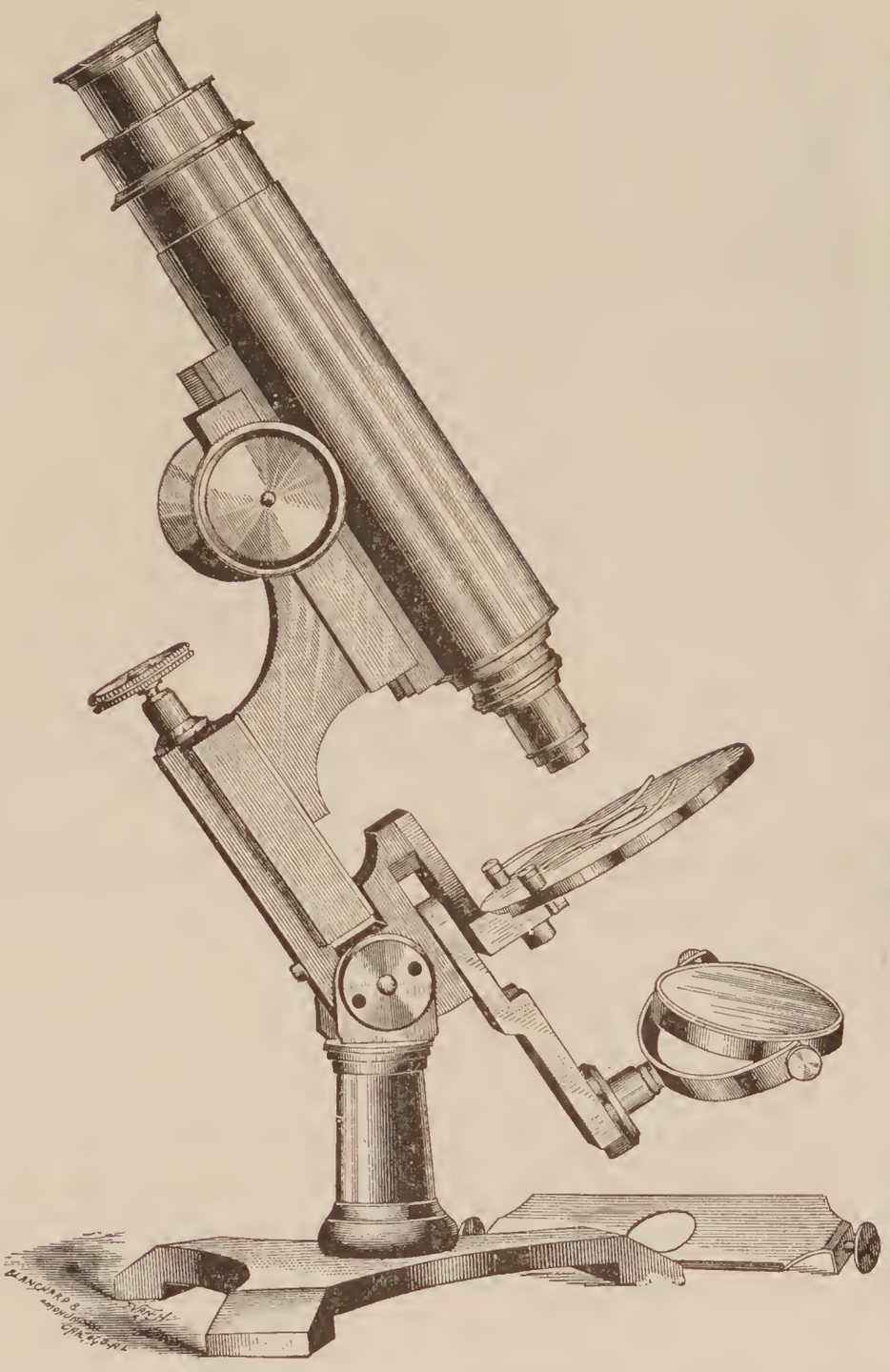

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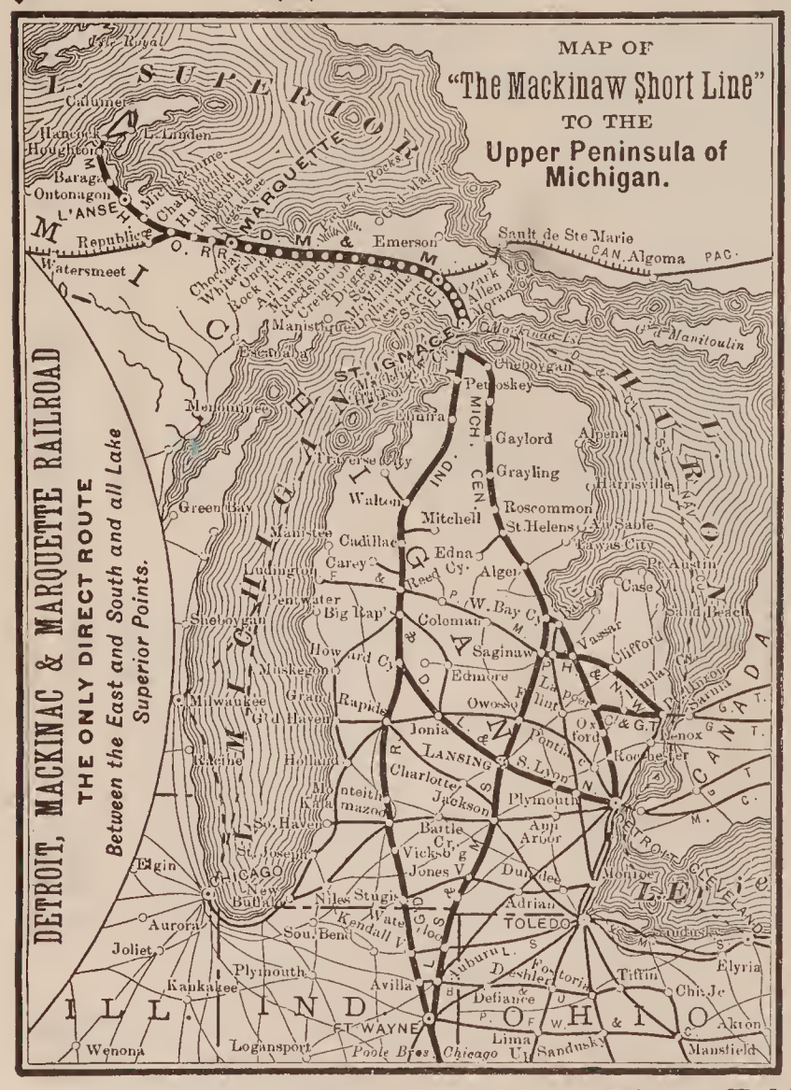

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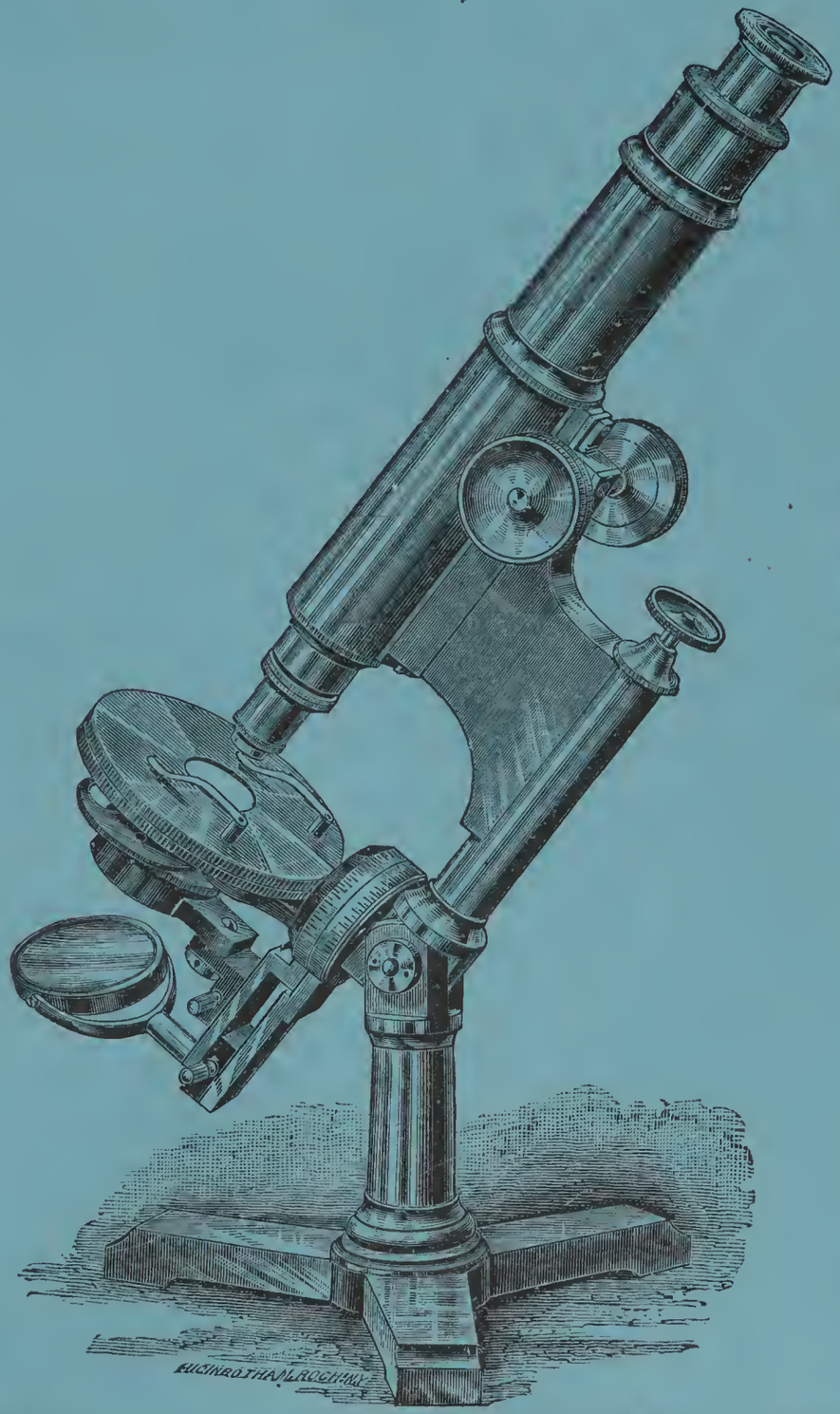

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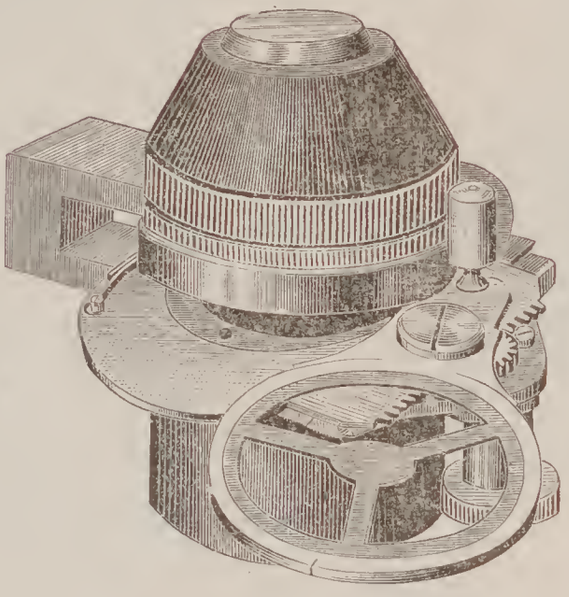

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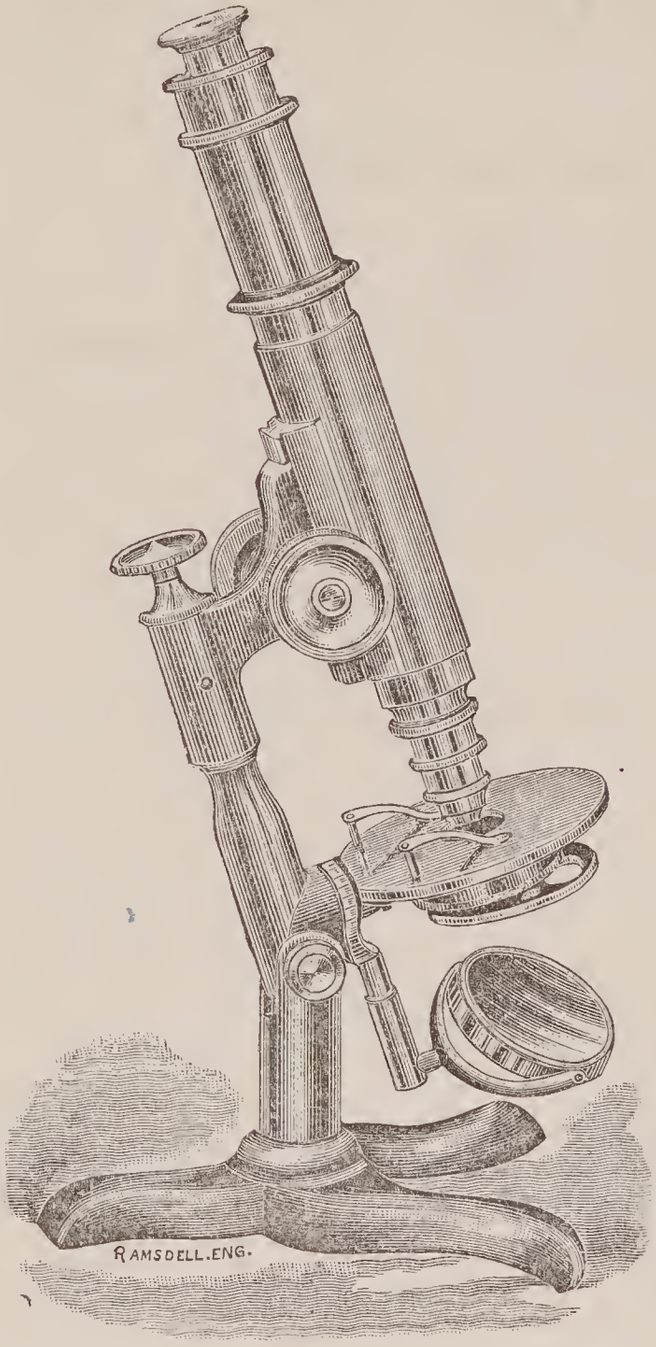

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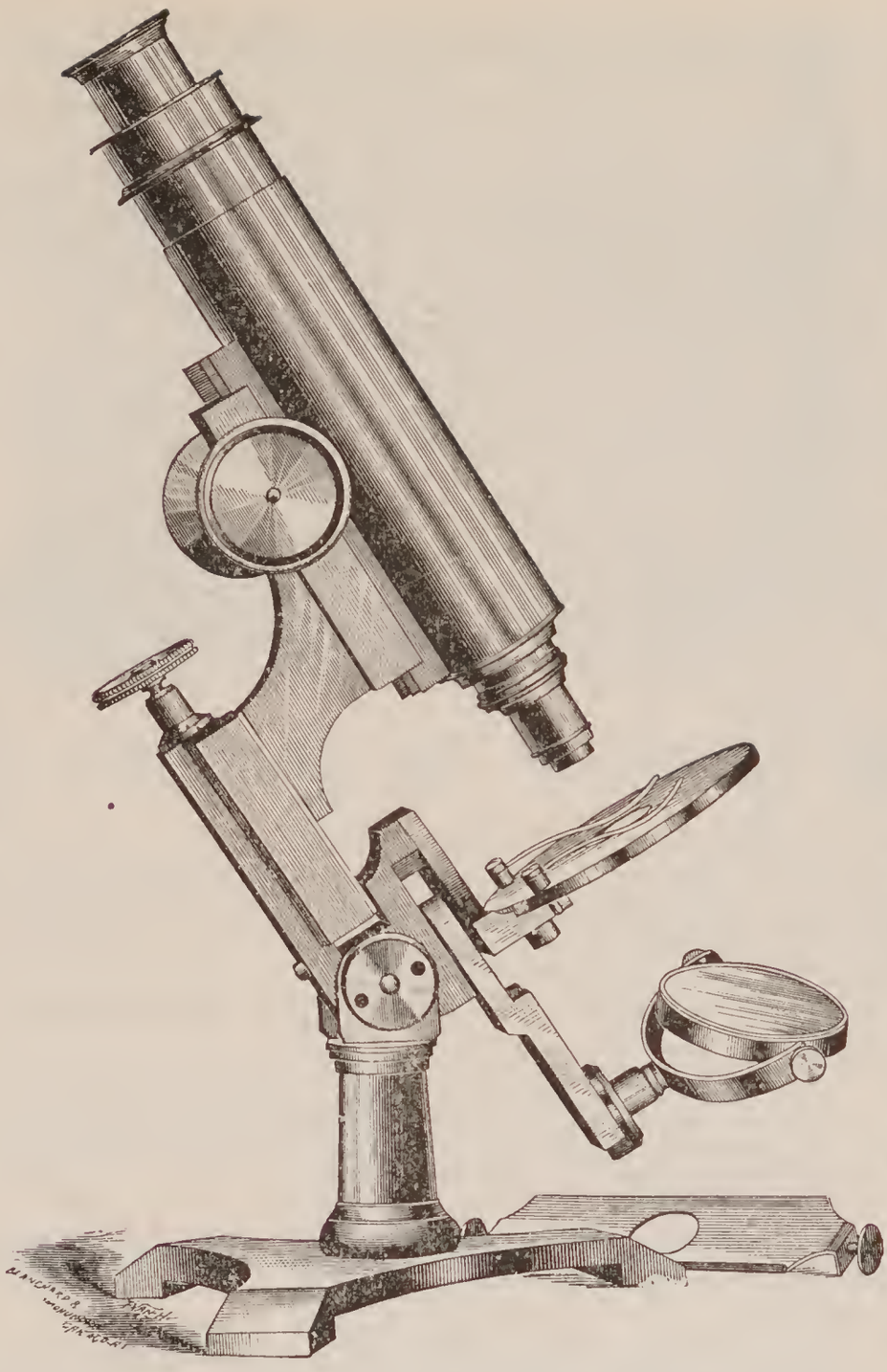

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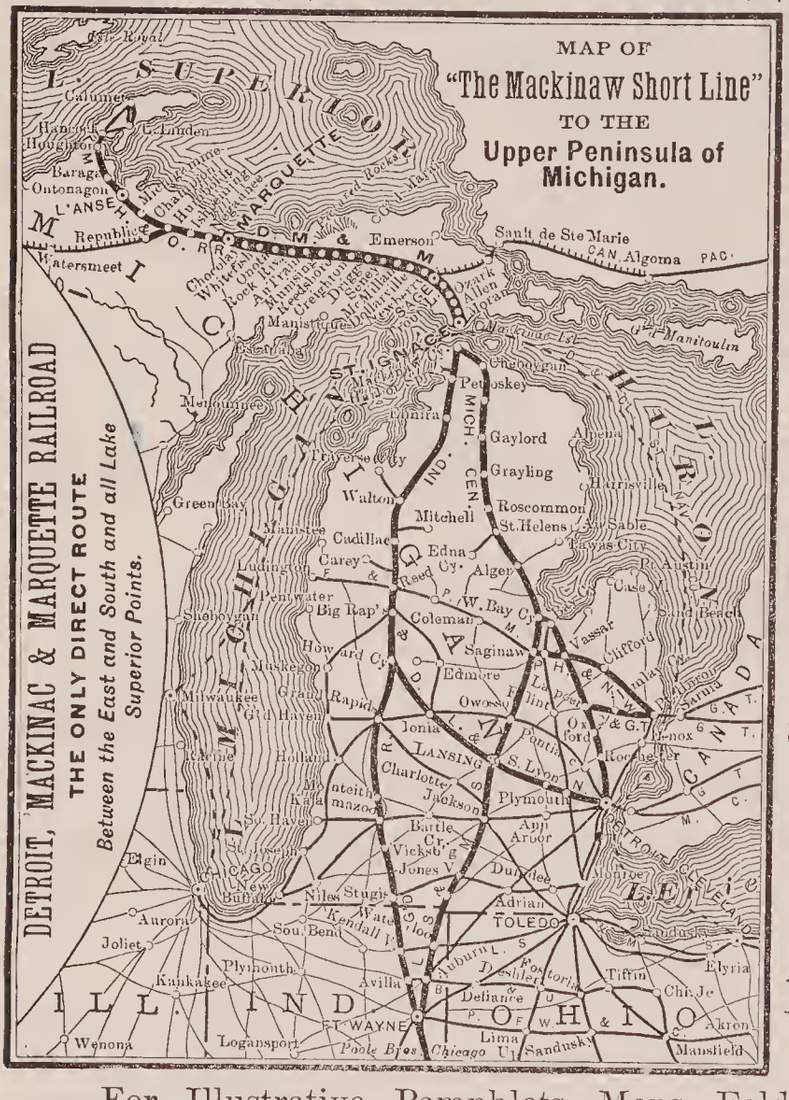

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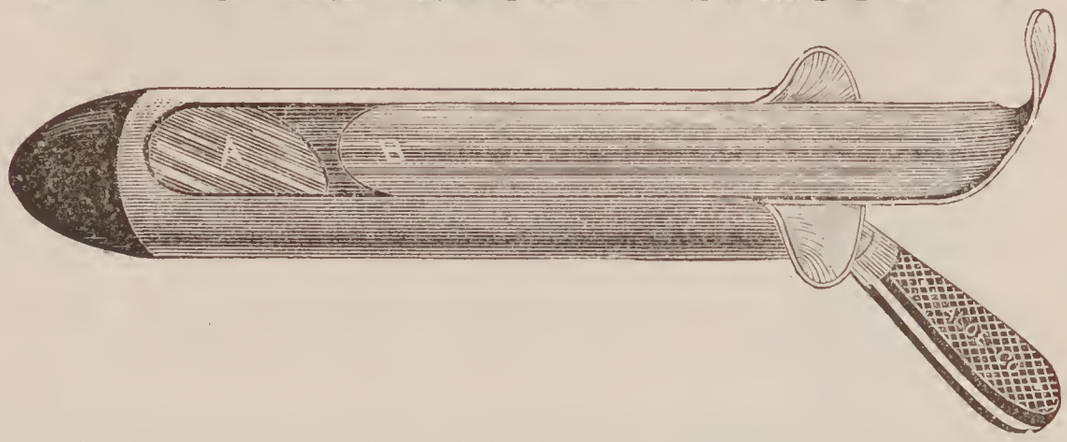

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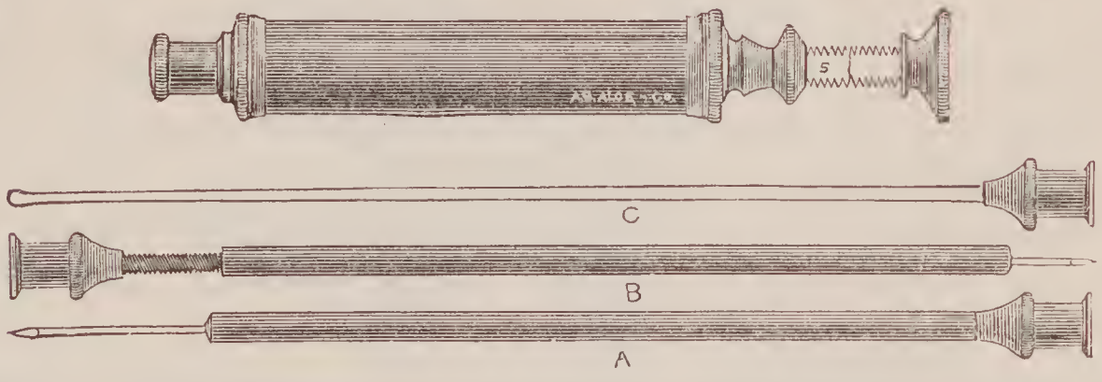

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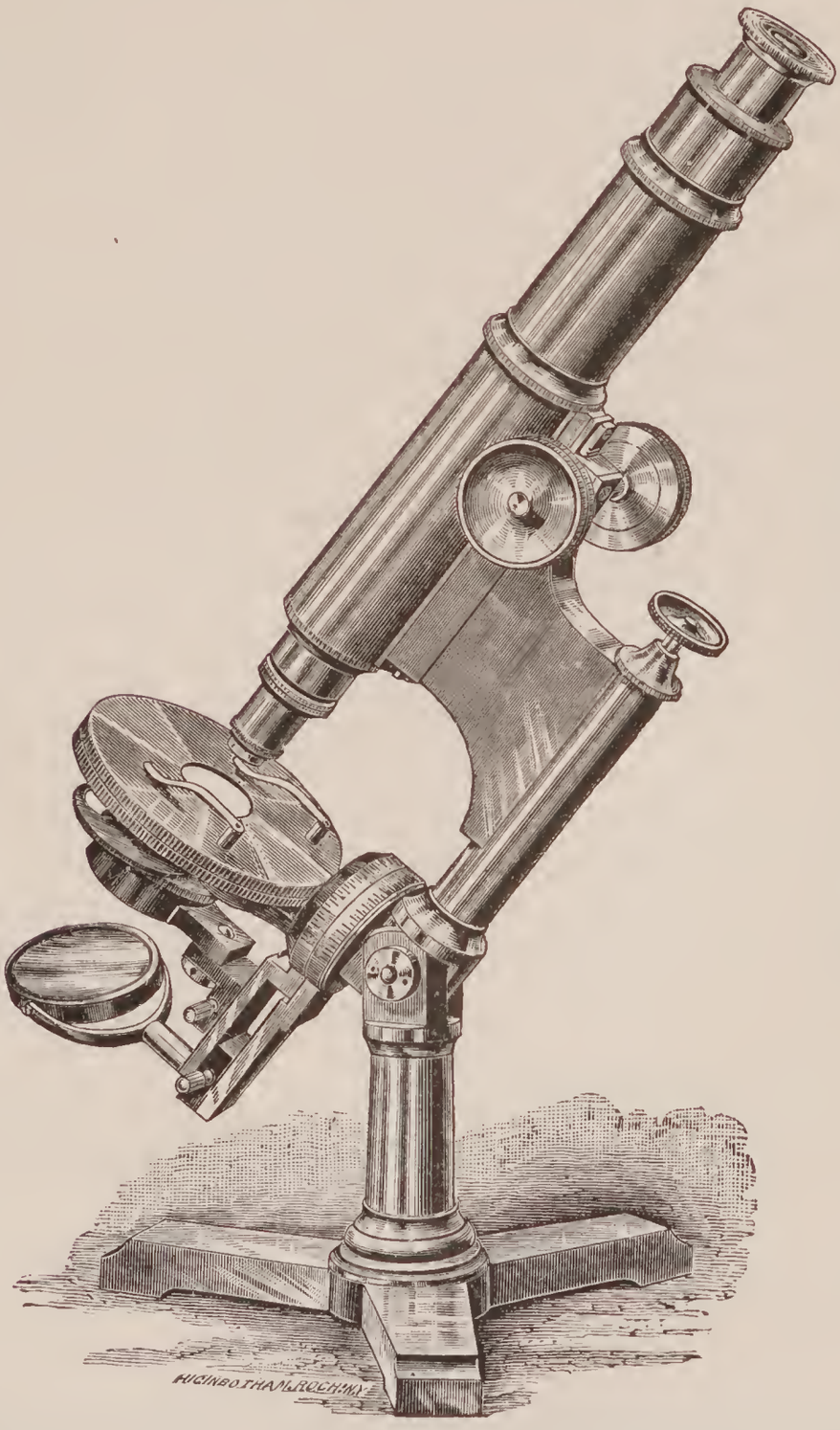

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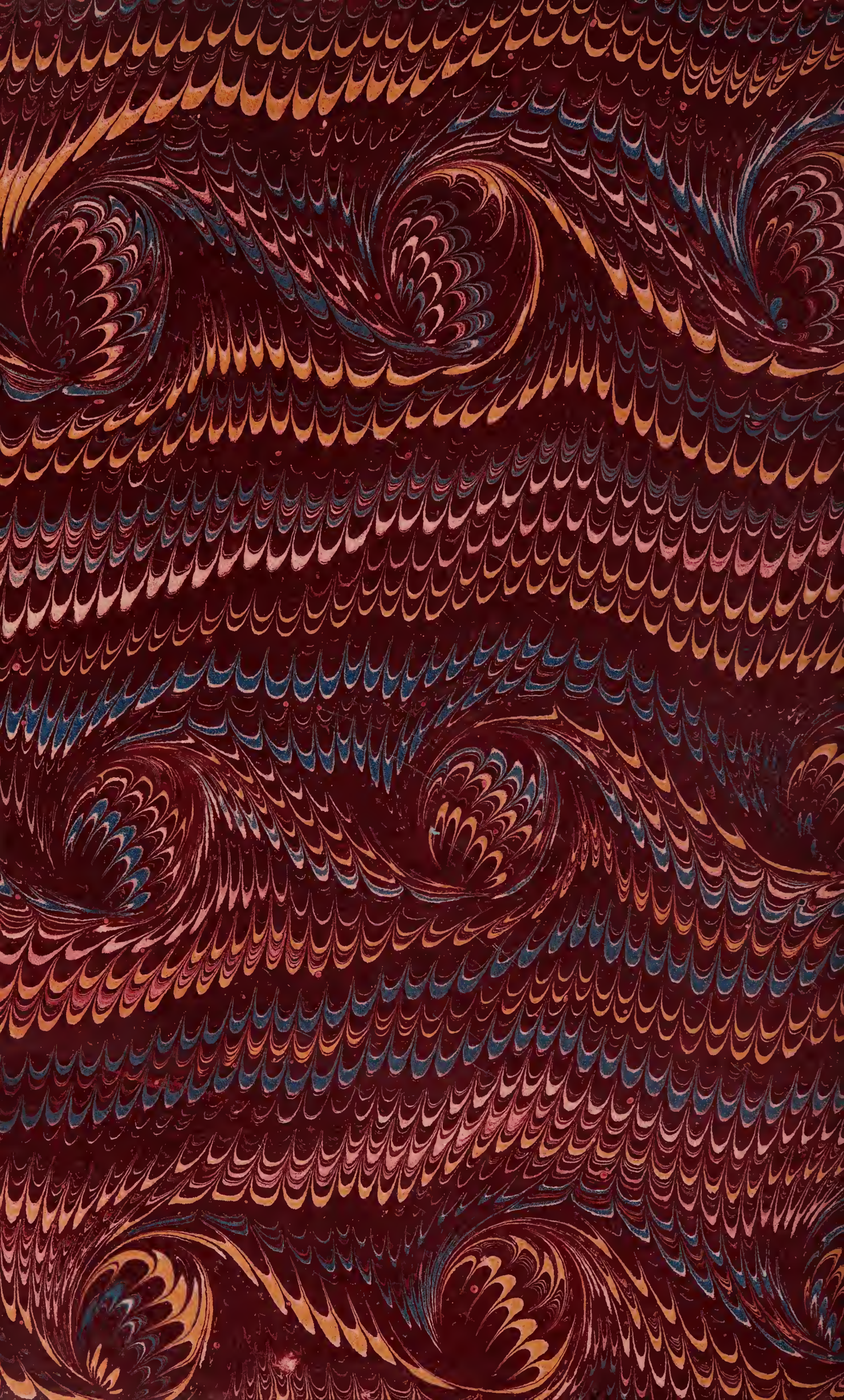
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